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PARIS EXHIBITION—THE FACADES OF ANNAM, PERSIA, SIAM, TUNIS, MONACO, AND SAN MARINO.

This group of nations is gathered upon a space which does not exceed thirty-three feet. The first of these façades, at the left of the engraving, is the product of the joint labors of the three smallest states of Europe—two republics, San Marino and Val d'Andorre, and the principality of Monaco. The ground floor of the edifice has a door with a pediment sustained by two columns belonging to Monaco, whose escutcheon, with the device *Deo Juvante*, appears over the door.

The first story has a large glass window which belongs to San Marino, whose escutcheon bears the proud motto *Libertas*. Upon the cornice is placed the escutcheon of Val d'Andorre.

The regency of Tunis is represented by a small edifice with alternate bands of red and white. The tower is Moorish, and the front is furnished with ornamental windows. The frieze is of many colors, and below it there is a shield bearing the name of Tunis in Arabic characters.

Siam is not less elegant. It has a door opening under a sort of vestibule of wood inclosed by tapestries. Above the door is the escutcheon, a white elephant. The upper story is rich in ornamentation, and is crowned by a triple roof of the Chinese style.

The gateway is covered by an ornamental roof of semi-cylindrical tiles, after the Chinese fashion. Upon the roof there is a crown work of red and gold, which supports the flag staff.

We take the engraving from *Illustration*.

New Explosive.

A new explosive agent has just been discovered by Professor Emerson Reynolds in the laboratory of Trinity College, Dublin. It is a mixture of 75 per cent of chlorate of potassium with 25 per cent of a body called sulphurea. It is a white powder, and can be ignited at a rather lower temperature than ordinary gunpowder, while the effects it produces are even more remarkable.

It has been successfully used in small cannon, but its discoverer thinks it will be of more service for blasting, shells, torpedoes, and like purposes. While ordinary gunpowder leaves about 57 per cent solid residuum after explosion, this leaves but about 45 per cent. It can be produced at a moment's notice by a comparatively rough mixture of the ingredients, which can be transported and handled without risk so long as they are separate.

The sulphurea discovered by Professor Reynolds can be procured in large quantities from a product of gas manufacture which is now wasted.

Dynamite and Water.

It has recently been shown that if dynamite is poured into water, the sand falls to the bottom and the nitro-glycerine floats on the surface, and explodes with its usual violence if the temperature is slightly increased. This will explain the cause of many of the serious explosions with dynamite when used in wet holes.

PARIS EXHIBITION—THE FACADES OF ANNAM, PERSIA, SIAM, TUNIS, MONACO, AND SAN MARINO.

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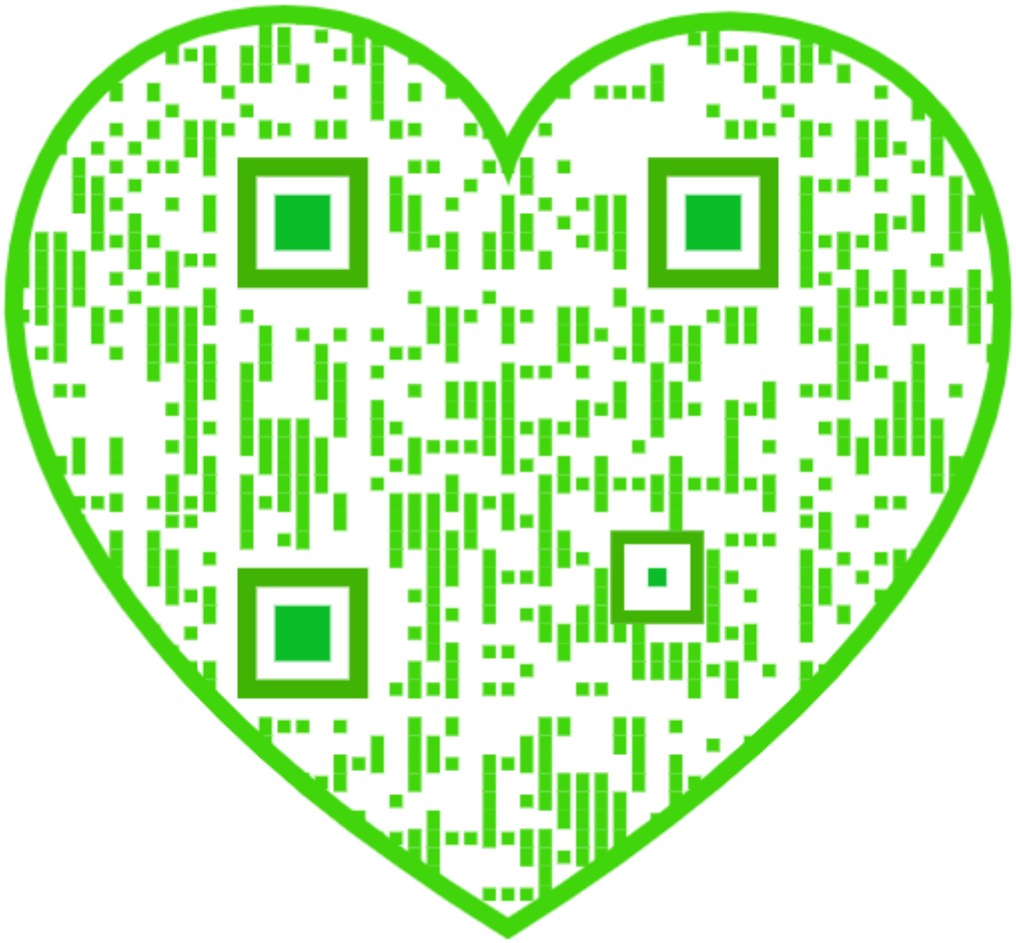

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NEW YORK, SATURDAY, SEPTEMBER 28, 1878.

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Water Supply. By JOSEPH PRESTWICH, F.R.S. Alarming pollution of water supplies. Interesting description of how our rivers, springs, wells, and artesian wells are contaminated. Relative value of the several sources of water supply, with the geological considerations involved.

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Printing Surfaces and Pictures by Photography. By THOMAS BOLAS, F.C.S. A lecture delivered before the Society of Arts, London. Photo-lithography and photo-zincography. Phototypic or raised printing blocks, by swelled gelatine process, zinc etching, and other methods. Line engraving on metal plates. Printing of half-tone subjects from metal. Application of Asser's process. Talbot's photo-engraving. Woodbury's methods of engraving and printing. All the processes and manipulations described at length, with recipes.

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The Stereoscope and its Uses. The principle explained; with 2 figs.—Lenhossek's Polo-Microscope. 6 figs.

VI. MEDICINE AND HYGIENE.—Contagious Diseases and their Prevention. By A. J. JESSUP, M.D. Description of means for preventing the spread of contagion, and putrefactive and inflammatory changes. Instructive quotation from Professor Tyndall. A simple cotton filter worn over the mouth as a protection against atmospheric germs. Successful surgery possible only in germless air. Description of model ward.—Therapeutic Value of Nitrate of Lead.—Carbolic Acid.—Treatment of Typhoid Fever.—Optical Defects and Spectacles. By DUDLEY S. REYNOLDS, M.D.

VII. NATURAL HISTORY, GEOLOGY, ETC.—That "Fatherless and Motherless Race." By Professor C. V. RILEY. The impregnation of the females of the basket-worm; with 7 figs.—The Enemies of Books, with fragments of old Books destroyed by the Traca 2 figs.

The Intelligence of Ants. A Paper read before the British Association by Sir JOHN LUBBOCK. His observations and interesting experiments. The architectural skill of ants; their concern for their young; their remarkable organization, their possession of domestic animals, and the institution of slavery among them. Habits of the hunting, the pastoral, and the agricultural ants. The exhibition of human traits.

VIII. AGRICULTURE, HORTICULTURE, ETC.—Sixty-one Bushels of Wheat to the Acre.

Cranberry Culture. By J. EDWARD WING. Paper read before the American Institute Farmers' Club.—Preparation of Bog. Cost and profits, from actual experience.—Bees.

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POCKET LIFE BUOYS.

On the evening of September 3, the excursion steamer Princess Alice, which was returning from Gravesend to London with about 800 passengers, largely women and children, was run into by a screw collier and quickly sank. The collision occurred off Barking, a town on the Thames, about seven miles from London. The loss of life was terrible, the estimates ranging from 500 to 650. The captain and nearly all the crew of the Princess Alice were drowned. "There was no time to lower boats," the report runs, and "there were but few life buoys on the steamer." Hundreds of women and children perished in consequence.

Such a disaster could scarcely occur in American waters for the want of life buoys, though an occasion for testing their efficiency is possible any day, among the scores of crowded excursion steamers that throng our harbors. So far as our observation has gone the provision of cork floats on our excursion and passenger steamers has been abundant and fairly accessible. Whether the majority of excursionists, in the confusion following a collision, would have the coolness and knowledge required to make proper use of the buoys, is less certain. Probably not ten women in a hundred on any steamer would be able to put on a cork jacket properly in time of peril, much less attach them to her children so that they would neither slip off the moment of striking the water, nor become misplaced so as to insure the holding of the children's heads under water.

Our purpose in speaking so plainly is not to create needless alarm, but to secure two practical ends: first, to convince all persons, women especially, of the need of becoming practically familiar with the construction and use of the life buoys provided on our steamers; second, to call the attention of the ingenious to the crying need of a cheap, portable life preserver—something that the hawkers might sell at the piers for twenty-five or fifty cents; something that could be carried in the pocket without inconvenience, easily and securely attached to the trunk or shoulders, and inflated, if need be, after the wearer is in the water; something that could be attached to a child instantly, or to the largest sized adult with equal facility. A circlet of waterproof cells, each provided with an automatic valve, so as to be easily inflated, and yet have all so independent of each other that the bursting of one would not affect the rest, would probably be as simple and efficient a device as could be asked for.

The conditions to be met are few—simplicity, lightness, portability, buoyancy, and cheapness. If these were fairly well met the single city of New York would furnish a market for thousands every summer. The inventor could not fail of an ample reward financially, in addition to the gratitude of the entire community.

THE HEROES OF THE PESTILENCE.

The old sentimental cry against the alleged materialistic and ultra practical tendency of scientific habits of mind—the charge that our busy, utilitarian modern life is essentially unheroic and fatal to the highest development of humanity—does not receive much support in times of public calamity and peril. The spirit of practical charity, of open-hearted self-sacrifice for humanity's sake alone, never prevailed more generally or showed results more praiseworthy than where the objurgated modern spirit most prevails. And it is a notable circumstance that the heartiest and most liberal responses to the call for help from the afflicted usually come from the busy marts of trade.

The record of the last few weeks, in connection with the plague smitten valley of the lower Mississippi, will compare favorably with that of the most heroic days of the unscientific past. And not the least noble of the grand army of workers for humanity, from Hickman to New Orleans, must be numbered many whose callings fall under the ban of scientific character and practical utility. At such a time invidious distinctions would be as cruel as uncalled for; yet, without detracting in the least from the credit due to the clergy who have not deserted their flocks, or to the sisters of charity and other volunteer nurses who have shrunk from no labor or peril in the disheartening work of nursing the sick and burying the dead, we may say that the votaries of utilitarian science have not stood last in the public demonstration of true heroism. Among these we must number the scientific physicians who have periled their lives or sacrificed them outright in their unpaid work among strangers; and we must not forget the obscurer yet not less generous heroes who have stayed to keep up communication with the outer world, and to study the climatic condition and changes, the mastery of which may some day make the spread of pestilence impossible. The telegraph operators, who have stuck to their posts, or who have volunteered to take the places made vacant by death, are proof enough that the sentimentalists are wrong. No more splendid heroism was ever displayed than by young Redding of Grenada, and others like him in every fever smitten town. To labor as they have had to in the midst of peril, while kindred and friends are fleeing or dying, passively enduring privation, exposure to the disease, ceaseless emotional strain, and the prospects of a sudden and terrible death, that the afflicted may not be deprived of means for making known their condition and want, calls for more patient and sterling heroism than is required even in the watchers in the chambers of death.

And of the sergeants of the Signal Service—a calling still more scientific in scope and aim—not less must be said. Several have already been struck down, yet the perilous work of observing goes on, fresh volunteers stepping forward to fill up the broken ranks. It is of these that a contemporary has eloquently and justly said that they deserve all the more honor because their work apparently has but a remote bearing in checking the disease.

"The physician, the Howard nurse, the clergyman, who remain faithful to their work in that dreadful valley of death, are at the bedsides of the sick and dying. They can see and feel the good results of the tremendous sacrifice they make. But the Signal Service officer gives his life to set down observations on rain and wind. Science, with the material he accumulates, may stay the march of the pestilence hereafter; but he does not know that. Nobody knows him, or the nurse who falls at his post. The papers have ceased to name them in the haste of the wholesale slaughter. 'What good, then, to the world did Priscus do, who was but a single person and unknown? Why, what good doth the purple to the garment? To make it royal and beautiful?'"

It is true that the dominant spirit of the age is scientific, and science is essentially utilitarian in its character and results. But the utility it seeks is the highest—truth, and human well-being, founded on real knowledge and right action, re enforced by the largest attainable command of the useful materials and forces of nature. If it fails to develop the highest traits of humanity, as the anti-scientific have so often asserted, then the records of the past must have been strangely falsified, to say the least. Certainly no other age, no other phase of civilization, ever outshone the present in those traits of humanity which go to enhance the essential nobility of man.

SILVER MINING HERE AND ABROAD.

Each week's reports bring additional evidence that the constantly increasing and usually profitable production of our mines is generally accepted as proof that the better knowledge of the sciences of mining and reduction of the ores arrived at by managers and superintendents has reduced the risks in this business to nearly if not quite the measure of those of ordinary commercial transactions.

And not only with us, but in other countries as well, are idle capital and labor being turned in this direction; everywhere there seems to be an increasing inclination for new fields of enterprise.

According to the *South Pacific Times* of Peru the great works in progress at Catapilco have effectually aroused people to a belief in the auriferous wealth of Chili, so long despised, and there is delving and digging all over the republic. In localities where profitable mining has been carried on on a reduced scale for years, additional capital is being invested, and there seems to be good reason to believe that this long neglected branch of industry will now receive proper stimulus.

Government engineers are now examining the different routes in the province of Carabaya, one of the richest though most inaccessible parts of Peru. It contains immense alluvial gold deposits which were profitably worked by the Spaniards until 1767, when the Indians drove them out.

A wise policy now actuates these governments to afford proper facilities and safeguards to the miner.

We learn, too, that there is now every prospect of prosperity in the mining interests of Sonora, which have so long been affected by incessant political disturbances; one mine there, the San Marcel, yielded over $1,000,000 of silver in a short time, but came to grief through the most extravagant and reckless working; but such occurrences are not likely to be so common in the future; they are now the exceptions where formerly they were the rule.

With us, even in San Francisco, the increasing distrust of speculative mining companies is a most welcome and healthy indication; their chances for successful imposition are rapidly growing less, and with their suppression comes the opportunity of making legitimate mining one of the most profitable as well as one of the safest businesses of the country.

Nothing new is reported respecting the Canadian or Australian gold fields; the former, indeed, are rather a matter of the past.

The investment of English capital in our mines is still on the increase, drawn hither, it would seem, rather by the promise of permanent investment than because of promise of profit, if we are to judge from the many prominent instances of the peculiarities of English mine management here.

The Richmond mine of Nevada, owned in England, continues to make good returns of bullion, but the inevitable quarrels of the stockholders with each other, and about the management of the property are not unlikely to result in their throwing away the mine for the pleasure of convincing themselves that they have been swindled by somebody.

The other companies of the Comstock lode are making every effort to find the rich vein which has been struck by the Ophir and Sierra Nevada, and which is supposed to underlie them all. Their future prosperity depends, apparently, upon their success.

Though Arizona accounts are still of rich mines and new discoveries, the general complaint of scarcity of water for mining purposes grows louder. The richest ores are transported to San Francisco for treatment, a proceeding which must greatly reduce mining profits.

An instance of good management which is daily becoming more common is that of the Idaho mine of Grass Valley, with a capital of $300,000. It has paid in dividends since 1869, $2,500,000, without calling an assessment, and is now increasing its working capacity.

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Colorado seems to be the favorite district for investment of New York and other Eastern capital because of its comparative proximity to us and of its good average returns on careful investments, but a great loss of gold is reported in the working of the rich telluride belt of Boulder county, and some improved method of working is imperatively demanded. Here is a good opportunity for inventors, for the telluride ores are among the richest known.

The gold mining business on our Atlantic coast is generally characterized by extreme slowness; stronger organizations and improved methods of working are here needed for fair development of the mineral wealth.

The general and well considered renewal of these industries cannot fail of exercising a beneficent and extensive influence throughout the country.

CORUNDUM.—ITS OCCURRENCE AND DISTRIBUTION.

The recent publication in the SCIENTIFIC AMERICAN SUPPLEMENT (*vide* No. 125, for 1878) of an elaborate paper on the industrial applications of emery and corundum has attracted such general attention that the presentation of an article upon the distribution of this useful mineral, and the quantities available for the future demands of industry, will be read with interest.

All, or nearly all, the deposits of corundum of any magnitude found in the world occur in the serpentine (or crysolite) formations, or in rocks immediately adjoining, and associated with these.

In this country it has been found in such association in numerous localities from Massachusettes to Alabama, and in certain parts of this range of occurrence in deposits of considerable magnitude.

The most important deposit in the Eastern States is that found at Chester, Mass., where, in a vein four feet in thickness, it has been traced with reasonable evidence of continuity over a distance of four miles.

The corundum of this locality is more or less abundantly mixed with iron oxide, and in this respect, as well as from its somewhat granular texture, it approaches in constitution the variety known as emery.

Small quantities of the mineral have also been found at Pelham, Mass., and at Litchfield, Conn. The Chester deposit has yielded considerable quantities of the mineral, and is still being worked.

In Pennsylvania, corundum has been found in many localities. One considerable deposit at Blue Hill has been traced with more or less certainty for about five miles, to near Rockdale, in Delaware Co. It has also been detected at Mineral Hill and Black Horse in the same county. At both the last named localities no deposits in either have yet been found, although the evidence of their existence is made probable by the finding of isolated bowlders and fragments of the mineral.

The largest occurrence of the mineral yet found in Pennsylvania occurs at Unionville, Chester Co., where it forms a deposit of from five to ten feet in thickness and of unknown extent. This mine has yielded considerable quantities of the mineral, but is not being extensively worked at the present time. The product of this mine is very pure, and has been pronounced by experts to be superior in cutting qualities to the finest Turkish emery. It is prepared and brought into the market, ground like emery, graded in various degrees of fineness from grains to flour. Concerning the available quantity of the mineral at this locality, but little positive information exists, nor has the mine been worked steadily. Some shipments from this mine have been made to England. From surface indications based upon lithological characteristics, the inference would appear to be warranted that in this region of Southeastern Pennsylvania corundum will be found in quantities sufficient to meet any probable demand for it in the near future.

Proceeding southward, it may be worthy of notice that corundum has been found in Virginia, at Staunton, in Augusta Co., but only in isolated specimens. By far the most numerous and interesting occurrences of corundum in this country occur in the State of North Carolina, where there is a corundum belt, which stretches, with occasional interruptions, in a southwesterly direction from Madison Co. through the State of Georgia, and into Tallapoosa Co., Alabama, a distance of at least 250 miles.

The variety, beauty, and purity of the corundum in many parts of this belt are unequaled, exhibiting in many instances huge crystals and splendid crystalline masses, showing perfect cleavage, and displaying the fine red and blue colorations of the ruby and sapphire. It has been mined at several points in North Carolina, especially at and in the neighborhood of Corundum Hill, near Franklin, Macon Co., by Col. Jenks and others, but whether because the demand for the mineral is limited, or because of the expense of mining and transportation to market, these deposits have not as yet attained much commercial importance.

Gainesville, Hall Co., Georgia, and Dudleyville, Alabama, may also be named as localities in these States respectively where the mineral has been detected in considerable quantity. From the foregoing *résumé*, it will appear that there is no dearth of corundum in the United States; and that should an extensive demand grow up for it in the several industries in which it has been successfully applied, the home and foreign markets could be abundantly supplied from our domestic deposits.

Concerning foreign occurrences of the mineral, the following brief summary may be of interest:

Professor Rose, of Berlin, has described an occurrence of corundum at Mramorsk, in the Ural regions, where it occurs associated with serpentine and allied rocks. The mineral appears, from his account, to be too much disseminated in the accompanying chloritic schists to promise any commercial value.

Great deposits of the impure dark granular variety of corundum, known as emery, occur at Naxos and Nicaria, in the Grecian Archipelago. There are also numerous deposits in Asia Minor, discovered by the American chemist, Dr. J. Lawrence Smith, to whose scientific zeal, combined with a keen practical perception, the Turkish Government is indebted for the creation of a valuable industry. Of other deposits of the mineral, in India and elsewhere, but little is positively known.

NOTES OF PATENT OFFICE DECISIONS.

In Sheldon's case, the subject matter of his application consisted in incorporating in a railway passenger ticket a contract with, and a personal description of, the purchaser. The ticket was one of that class which is good for a certain trip and for a certain length of time, and is not transferable.

The contract was to be signed by the purchaser in the presence of the person who sold the ticket, and contained a provision that in consideration of selling the ticket at a reduced rate, it should be good only for the person named and described, for the passage and time mentioned therein; that if transferred to any other person it should be forfeited; that the execution of the holder's signature should be made in the presence of the conductor when required, etc. Following this contract was a form or schedule containing the personal description of the purchaser, together with his signature.

The personal description, and the requirement that the purchaser should sign his name in the presence of the conductor upon the delivery of the ticket, when requested by the conductor, were the means of identification adopted by the applicant for a patent. His claim was for the ticket, with the description and executed contract, arranged substantially as shown and described.

The acting-commissioner finds that, considered as a mere structure, the claim was made up of three elements, all of which were old, and each of which performed the same function that it had performed in other places and in other kinds of business. A non-transferable ticket was old; the contract signed by the purchaser was old; and the personal description of a person holding a contract or other paper, by which he might be identified, was also old. It was a common means of identifying depositors at banks to require the depositor, upon drawing from the bank, to write his signature, for the purpose of identification by comparison with the signature already recorded in the books of the bank. It was a common method in the military service, upon giving a discharge to a soldier, to incorporate therein a description of his person for the purpose of subsequent identification. It was usual also to incorporate a personal description in a passport.

The acting-commissioner, however, holds that the matter should not be regarded as a structure; but that if patentable at all, it was as a new method of doing business.

The primary object of this railroad ticket, like all other similar tickets, was to grant the privilege to a purchaser thereof to travel on a certain railroad over a certain distance. It was the token of a contract entered into between the railroad company and a passenger, by which contract it is provided that in consideration of a certain amount paid by the passenger he has the right to ride on the railroad mentioned, the distance therein indicated. Any conditions other than this are held by the acting-commissioner to be simply additions to the contract. The essence of this so-called invention, therefore, was a contract. The making of the original signature, the re-signing, and the submitting to a personal inspection and description on the part of the passenger, were all conditions of one and the same contract. An ordinary ticket without any signatures, such as is generally sold to passengers for a single trip, is a contract, and the present ticket is the same thing, with additional conditions annexed thereto. The case, therefore, resolved itself into the question: Does a business contract constitute a proper subject of a patent? The acting-commissioner answers the question in the negative, and rejects the application for a patent.

Trade with Russia.

Since the first of January, 1878, eighty-one shipments, consisting of tools, machinery, rope, and other articles, have been made from this country to Russia, through the efforts of a Russian gentleman who is trying hard to divert to this country that portion of the Russian trade now commanded by England. In a recent interview with a representative of the Philadelphia *Press*, he said:

"The trade of England with Russia amounts to 133,000,000 rubles. I do not despair of reducing this one half in favor of America within five years. We want to fight England; if we cannot do it by warfare, we can by striking at her where she is most sensitive and vulnerable—in her trade. I find your manufacturers here willing to lend their aid and to sell for the smallest profit, looking to the future. It keeps the mills going; it brings our money here instead of to England. In Pittsburg and Oil City, and especially here in Philadelphia, where I have had transactions, I find everybody willing to co-operate in this way, and I have found assurances that distance will be no barrier to a successful trade. There is now, more than ever before, a splendid field for American goods in Russia. It is not to be supposed that we will put one cent more than we can help into British pockets, while we do want to build up our trade and more closely cement our friendship with America. But one thing must never be forgotten. The goods must be of the best quality; the price must be such as to compete with the British. There is no sentiment in business. I venture to say that if an effort is made here by your merchants to push a trade with us on these terms, they will find a most gratifying response."

Patentees Rewarded.

The following compiled from the *Tribune* indicates the manner in which Great Britain rewards her inventors:

Since 1860 England has paid £102,775 to inventors for discoveries in connection with ordnance and small arms. Mr. Henry got £5,600 for breech-loading rifles and improvements in firearms; Mr. Westley Richards, £2,375 for his breech-loading carbine; Mr. Snider, Mr. Wilson and Colonel Roden, £16,000 for their plan for converting muzzle-loaders into breech-loaders; Colonel Snider got another sum of £5,000 for the Snider rifle, and Mr. Lancaster £4,000 for his plan of rifling guns and small arms. In artillery, Major Palliser got £15,000 for his chilled projectile, £7,500 for his plan for converting cast iron guns, and £1,500 for improvements in artillery; Captain Moncrieff got £10,000 for his method of mounting guns, with £1,000 a year and £5,000 when his engagement ended in 1875; Mr. Hale got £8,000 for rockets; Mr. Frazer, £5,000 for construction of guns; Captain Scott, £2,000 for improvements in gun carriages and £8,000 for other gunnery inventions, and Commodore Harvey, £16,000 for torpedoes.

The Velocity of Light.

One of the most important papers read at the recent meeting of the American Association was that by Albert A. Nicholson, of the United States Navy, on experimental determination of the velocity of light. He said:

"The two methods by which the velocity of light was determined experimentally gave in the hands of Foucault and Cornu results which differ by nearly 1 per cent. To find the correct result is the object of the experiments I have undertaken. The method which I have adopted is essentially that pursued by Foucault, but has this important advantage, that it permits the use of any distance between the mirrors. This is accomplished by using a lens of great focal length, which collects the light from the revolving mirror into a series of parallel pencils, which are reflected back from the surface of a plane mirror. The distance between this and the revolving mirror in the preliminary experiments was 500 feet, and the displacement obtained was 0·63 of an inch—about 25 times that obtained by Foucault. The apparatus used was adapted from the material found in the Naval School, and the experiments were performed under difficulties. The following is a table of results: 186,730; 188,820; 186,330; 185,330; 187,900; 184,500; 185,000; 186,770; 185,800; 187,940; 186,508 mean. 186,600 Cornu. 185,200 Foucault."

Remarkable Steamboat Speed.

The highest speed ever attained by any boat or ship was that obtained by the steam launches recently built for the English Admiralty by Messrs. Yarrow & Co.

The boats are each 85 feet long, 11 feet beam, and draw 3 feet. They are constructed of steel, and have engines capable of indicating 420 horse power.

Run with the tide the one made 22·59 knots, or 26 miles per hour; the other, 23·92 knots, or 27·56 miles per hour. Against the tide, one made 17·69 knots; the other, 18·09. The mean of the two was, respectively, 20·14 knots, or 23·2 miles, and 21 knots, or 24·2 miles.

The Strongest Steamer in the World.

The Italian Government has just launched the ironclad Dandolo, sister ship of the Duilio. Both are to be armed with 100-ton guns, and be armored with 22-inch plates. Not content with these ships, which carry heavier metal than any one in the English navy (the English Inflexible has 24-inch armor, and carries a pair of 80-ton guns), the government is constructing two others, which are to be armored with 24-inch plates, and are to carry cannon of perhaps 200 tons.

It is a matter of general surprise that Italy should be expending enormous sums for such an irresistible navy. Simple pride of possession cannot be the only impelling motive.

A Runaway Reaper.

The Salem (Oregon) *Statesman* tells a funny story about the performance of a self-binder reaping machine while following unattended a team of runaway horses. Their course lay through a field of wheat containing about a hundred acres; and, strange to say, the machine kept together, and bound every bundle that came to it with lightning rapidity. When the team was stopped, the machine had cut and bound about a hundred and fifty bundles; but the swath was "crookeder than the tangle of the Mollala."

EACH inhabitant in the United States pays $2.02 for the support of the public schools, and $1.39 for military purposes. These two items of expenditure in other countries of the world are as follows: Prussia 51 cents and $2.29; Austria, 34 cents and $1.39; France, 29 cents and $4.50; Italy, 13 cents and $1.57; England and Wales, 66 cents and $3.86; Switzerland, 88 cents and $1.

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THE CAPTIVE BALLOON—APPARATUS FOR TESTING THE STRENGTH OF MATERIALS.

For over a month, the Captive Balloon has been operating with such precision, and so safely, as to justly excite the admiration of those who have it in charge, as well as of those who take part in its ascensions. These results have been attained by M. Giffard only by the extreme care which he has taken to thoroughly test the strength of the various materials which were used in its construction. Fig. 1 represents the apparatus which was employed to ascertain the tearing resistance of the stuff of which the body of the balloon is made. A strip of the material, two inches in width, is fastened by means of the vises, V and V', between the clamps, *m* and *m'*. By turning the crank, M, the clamp, *m*, is caused to separate further and further from the clamp, *m'*, and the fabric stretches up to the point where it breaks. A hand, moving around a semicircular dial, represented at the left of the engraving (Fig. 1), gives the amount of strain in kilogrammes. Underneath, at B, may be seen (represented one fifth natural size) a piece of the stuff thus broken. A strip like this, two inches wide, requires an effort of 420 lbs. to tear it. The material of the balloon stretches about one tenth before it breaks. The balloon, therefore, would be able to increase more than one quarter in volume before the material of which it is composed gave way to the pressure.

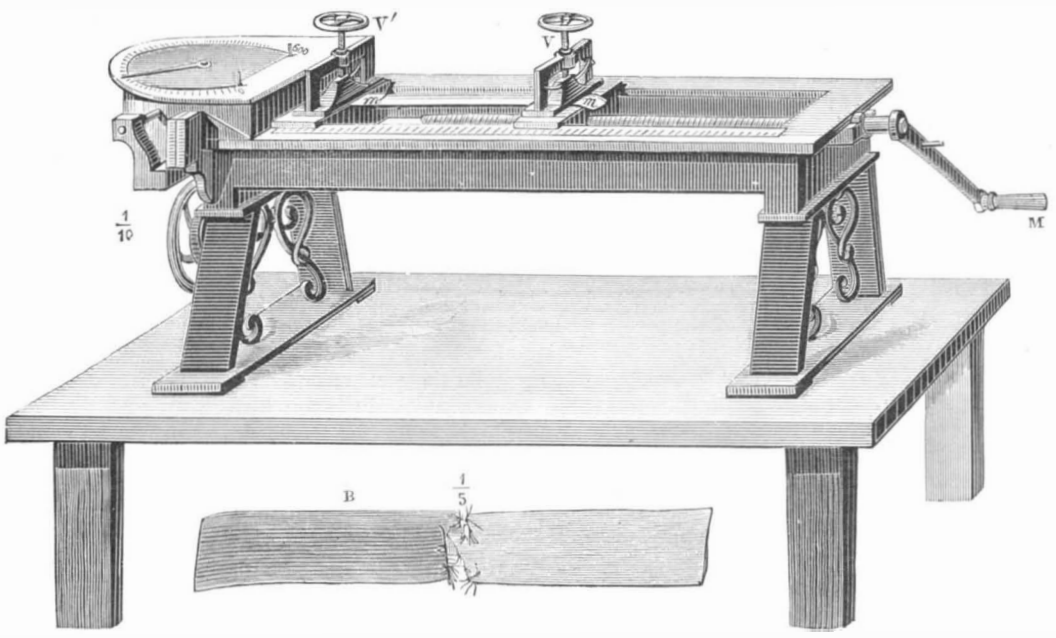

Fig. 1.—APPARATUS FOR TESTING THE FABRIC OF THE CAPTIVE BALLOON.

The apparatus just described for testing the resistance of the fabric was not entirely unknown before; but the machinery for ascertaining the strength of the cable (a matter of no less importance) is entirely new, and M. Giffard's own invention. This apparatus, represented in Fig. 2, is composed of a solid frame of wood, upon which is placed the hydraulic press which is to determine the rupture of the portion of the cable submitted to trial.

At the bottom of the engraving, to the left, is seen the double pump which forces the water up to the hydraulic press. Under the piston of this press are suspended, by means of a crosspin, two cranks, which are provided at their lower ends with a second crosspin, around which is fastened one of the extremities of the piece of cable to be tested. The lower end of this piece of cable is attached to a third crosspin, fixed to the lower part of the framework by means of a stout band.

At E is represented an accumulator, which, at the moment the cable parts, prevents any shock to the manometer that will be described further on. The tube which leads the water to the accumulator is connected at A, and the one that leads to the manometer is fitted at the point, E. The pipe, B, figured against the right hand standard of the frame, serves to allow the escape of air from the press the moment it begins operation.

The manometer for measuring the amount of pressure exerted is represented at C. It is entirely new, and is one of the most interesting devices of the whole system. This apparatus is formed of a flattened tube wound spirally a number of times, and its proportions are such that it may be made to indicate a pressure as high as 300 atmospheres. It causes the index hand to move around the whole circumference of the dial, without any interference and without any multiplication of movement. The apparatus is at once exceedingly correct and very powerful. By means of it M. Giffard has ascertained that, to break the small end of the cable, it needed a pressure equivalent to a weight of more than 61,000 lbs., and for the large end more than 79,000 lbs. When we reflect that the Captive Balloon never exercises a traction of more than 17,000 lbs. on the cable, and that while in operation the latter is submitted to no friction, we will readily perceive that nothing can detach the captive monster from its place of anchorage.

Admitting the possibility of such an occurrence, let us see what would happen. The balloon would simply rise rapidly in the air, and the lower automatic valve would immediately open under the pressure of the gas. During the first minute the balloon would lose 80,000 lbs. of ascensional force; it would lose a little less during the second minute, and so on during the subsequent minutes. Under such conditions, owing to the working of the automatic valve alone, the balloon would not be able to rise to a greater altitude than 8,000 feet. We are supposing in this case that the balloon was permitted to rise freely of its own accord; but such a circumstance would never take place in reality, since MM. Eugene and Jules Godard and Camille Dartois are always in the car, and the balloon is never allowed to make an ascension without them. Should the cable break these skilled aeronauts would bring the balloon down to *terra firma* again without the least accident.

But to return to M. Giffard's apparatus for cable testing: This invention is not only of interest in connection with balloon construction, for it is destined to render great service in the art of rope making, which has hitherto been greatly in need of just so accurate a system. It is also to be used, before long, in some other experiments, which are to be made at the factory of Messrs. Flaud & Cohendet, where it was constructed.

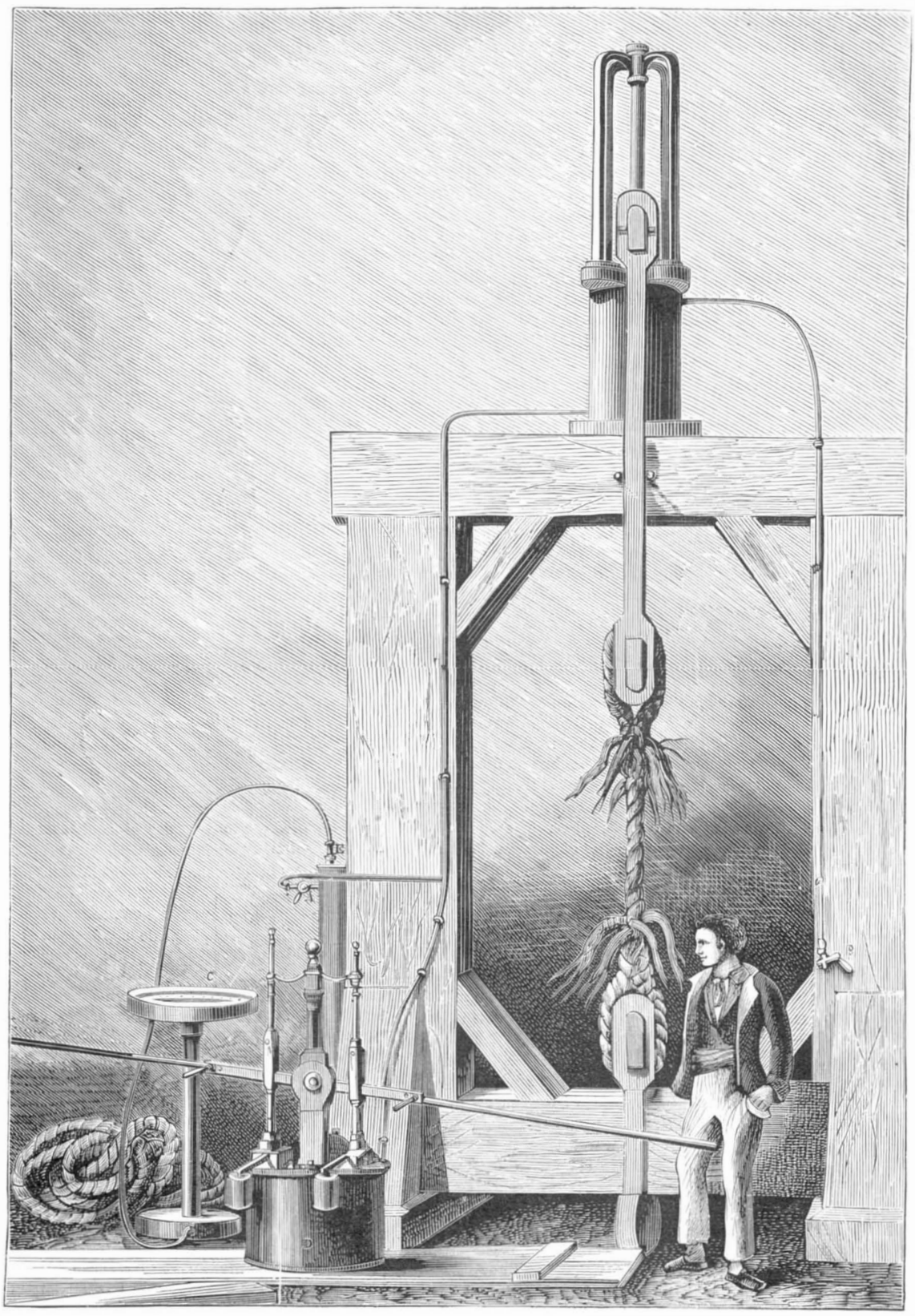

Fig. 2.—GIFFARD'S APPARATUS FOR TESTING STRENGTH OF CABLES.

Engineering Inventions.

An improved Portable Railway has been patented by Francisco Amat, of Havana, Cuba. This invention consists of a track section whose rails project at one end and partly over the wider cross tie of the adjoining section, said cross tie having locking plates close to the rails, that bear on the end tie and against the rails of the first section The locking plates have a slight upward curve at the end, and are also curved or rounded off at that side adjoining the rails.

Mr. Stephen Barnes, of New Haven, Conn., has patented an improved Gate for Railroad Crossings, that closes either the road at both sides of the railroad track or the track, admitting of the crossing of vehicles or not, according as the gate is set in either direction, the gate being held in either position reliably, and arranged to signal to the approaching train or to the vehicles the actual position of the gate.

Mr. Silas Hewitt, of Seneca Falls, N. Y., has patented an improved Car Brake, that exerts a double frictional action by contact with the wheels and rails, so as to be more powerful and effective than the single brakes which have heretofore been applied either to the wheels or to the rails.

Mr. William M. Stehley, of King William Court House, Va., has patented an improvement in Elastic Armor for Ships, which consists in alternating steel or iron plates and rubber cushions and springs for supporting the metal plates against the impact of projectiles.

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An improved Locomotive has been patented by Mr. Jacob J. Anthony, of Sharon Springs, N. Y. It consists in a hollow frame which forms the water tank, and at the same time supports the cylinders and valve gear, and is itself supported by the axles of the drive wheels. The invention possesses many other novel features which cannot be properly described without an engraving.

Mr. Nathaniel F. Gilman, of Rochester, Minn., has patented an improved Railway Car Truck. The object of this invention is to provide a safe and economical railway system. It consists in a track formed of I-beams set on edge, joined at their ends, and supported by suitable cross ties or sleepers. The inventor provides a truck of peculiar construction adapted to the I-beams.

Mr. Abraham L. Akins, of Greensburg, Pa., has devised an improved Treadle Motion for sewing machines, circular saws, lathes, and other light machinery, in which the reciprocating motion of a treadle is changed in connection with a spiral spring and intermediate oscillating parts into continuous rotary motion.

Improvement in the Leclanche Battery.

At a recent meeting of the French Academy, M. DuMoncel exhibited, on the part of M. Léclanché, a new model of the well known battery of the latter, designed to furnish a more constant current (as well as being more durable) than the form at present in use. In this new model the carbon electrode of the positive pole, instead of being immersed in a mixture of peroxide of manganese and carbon (from which it often becomes isolated when the battery is operated much), is completely detached; and, for the mixture, there are substituted two prisms of these materials, held in place against the two faces of the electrode by means of rubber bands. The simple contact of a fragment of this mixture is sufficient to quickly and powerfully depolarize a carbon plate; and this effect results from the local current developed in the contact of these two substances, which current causes the hydrogen from the carbon to be immediately absorbed by the peroxide. In order that their local current be better established, the prisms are hollowed out on the side of contact, and the depression filled with a layer of carbon, thus increasing their conducting power. By this means the negative electrodes may serve for an indefinite period (which is an impossibility in the form of battery in use at present), and when the prisms are used up new ones have only to be substituted. Moreover, in this model, the mixture can be more strongly pressed, and the resistance of the element remains uniform. This system, also, may easily be rendered portable for the use of physicians.

ANCIENT STAND FOR YULE LOG.

The days when

> "A Christmas gambol oft would cheer
> A poor man's heart through half the year"

are gone; but a few mementos remain to remind us of that happy period when holidays were looked forward to through weeks of pleasurable anticipation, and the remembrance of such a day lingered in the mind until the approach of another.

Anciently, on Christmas, a glowing fire was made of great logs, the principal of which was termed the yule log, or Christmas block, which might be burned till Candlemas Eve, to resist the severity of the weather. As ancient customs and the articles which are the necessary accompaniment of such customs are coming into vogue after having completed a cycle, we present our readers with an engraving of a richly wrought stand for supporting the yule log, which was in use in Venice in 1577.

Vital Resistance.

In summing up the results of a long series of observations on the effect of sunlight on bacteria and other organisms commonly associated with putrefaction and decay, Arthur Downes and T. P. Blunt remark that there is a lingering belief in the minds of many that matter which is endowed with life can, by its "vital resistance," the more endure and survive the effect of injurious influences. This belief receives no support from their experiments. On the contrary, they have met with results which are best explained by the consideration that bioplasm is matter of the utmost complexity and instability of constitution, ever changing and most unstable when the life forces are at their full.

The Largest Ship Ever Made.

It is said that the steamship Great Eastern has been purchased by a company who intend to use her as a cattle boat to ply between Texas and London. She is now being fitted out at Milford Haven, and is to have new engines and boilers, manufactured by the Clyde Iron Works, at a cost of $500,000. Refrigerators will be built in her for the purpose of carrying fresh beef. It is estimated that she will carry 2,200 head of cattle and 3,600 head of sheep.

A CABINET.

Drawing room furniture, although it may be of a lighter and perhaps more ornamental description than the more

CABINET FROM "ART IN THE HOUSE."

solemn fittings of the dining room, must follow the same general rules: it should be well constructed, suitable to its purpose, and thoroughly good. American walnut is a good wood for the purpose. It should be oil finished, so that it may be rubbed down from time to time and made as good, if not better, than new. Among the larger pieces of furniture for the drawing room may be a cabinet such as is represented in the accompanying engraving. It is of walnut ornamented with lighter and darker woods. The recesses and shelves have mirror backgrounds, which reflect the ornaments and give a brilliant effect to the whole.

Such a piece of furniture as this takes up the principal place in the room, and the rest of the wall space may be utilized for hanging book and china shelves, and smaller cabinets.

Military Boots.

The French military authorities have condemned the shoe and gaiter and favor the adoption of a boot which is formed of two pieces of leather, reaches some way above the ankle, and opens on the outside of the leg from the top to below the ankle bone. This opening is covered by a piece of soft leather, and closed by three short leather strings fastened to the boot on one side and three buttons. The pressure upon the instep and the tightness of the upper part round the leg can be regulated at pleasure; during any temporary halt, a man can throw the boot open and allow the air to circulate around and cool his feet; it can be put on and fastened without trouble in the dark; it effectually keeps out wet and dust, and the bottoms of the trowsers can be worn either inside or outside the boot.

New Mechanical Inventions.

Mr. Simon S. Zahm, of Huntington, Ind., has patented an improved Churning Apparatus, which is simple, convenient, easily operated, and effective, bringing the butter in a very short time, and with a comparatively small amount of labor.

An improved Machine for Skiving Boot and Shoe Counters has been patented by Mr. Seth D. Tripp, of Lynn, Mass. The object of this invention is to furnish a machine which will feed the counters to one knife for skiving one edge, and then carry the counters forward to a second knife, which skives the other edge, delivering the counter in a finished condition; also, to provide for the rapid sharpening of the knives without removing them from the machine. It has a feeding device, which will feed the counters automatically, one by one, at the proper speed.

An improved Gas Light Extinguisher has been patented by Messrs. Philipp Brand and Edward J. King, of Jacksonville, Ill. This device is to be applied to gas burners and their supply pipes, and is so constructed that the light may be extinguished by varying the gas pressure at the gas works or at other points, as may be desired. It may be adjusted to burn gas under high or low pressure, as required.

Mr. Thoro F. Greenleaf, of Westborough, Mass., has devised an improved Flour Dressing Machine, which has a casing of suitable form divided by transverse partitions into as many compartments as there are different kinds of flour to be bolted. The casing contains wheels composed of wire brushes and perforated wings or floats arranged in alternation, one of these wheels being placed in each compartment in the casing, and they are all mounted on the same and operated by the same driving mechanism.

Mr. James Hutton, of Denver, Col., has patented an improved Felly Joint. This invention relates to means for expanding the fellies of a wheel, and it is applicable to either iron or wooden fellies, and to fellies that are either sawed or bent.

Mr. William L. Orran, of Morris Gap, Tenn., has patented an improved Endless Chain Water Wheel, which is so constructed that the water may exert the full power of its weight for the longest possible time.

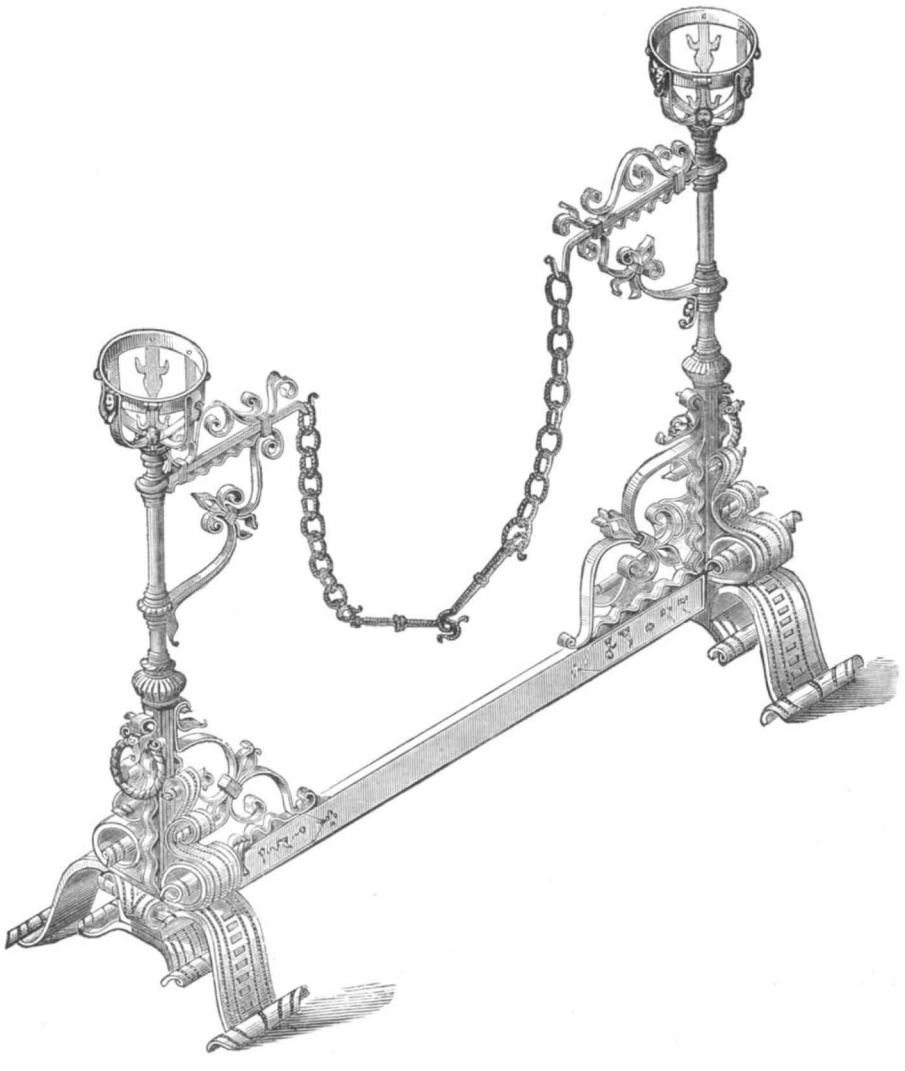
Mr. John Brant, of Providence, R. I., has patented an Apparatus for the Manufacture of Seamless Balls, which will enable seamless balls of any desired size to be made rapidly and accurately.

Messrs. Philip Van Tassel and Martin Paup, of Port Madison, Washington Ter., have patented an improved Steam Pump, which is so constructed that the valve may be operated, without any gear or other attachment, by the movement of the main piston, to change the position of the valve and reverse the motion of the main piston.

Mr. John H. Blain, of Round Rock, Texas, has patented an improved Horse Power. The object of this invention is to combine the principles of the lever and endless-tread horse powers in one machine, and utilize the weight of the horse or other animal; also, to construct a cheap and compact power which will be available for any purpose on a farm or other place where power is needed.

An improvement in Carving Machines has been patented by Mathew Rice, of Augusta, Ga. This device may be used in connection with lathes and other machines for carving, dovetailing, moulding, blind-slat mortising, and other descriptions of wood working.

An improved Wire Stretcher has been patented by Mr. Isaac G. Ericson, of Colorado Springs, Col. This invention consists of two levers pivoted a short distance apart to a bar or carrier near the center of the levers. The lev-



STAND FOR YULE LOG.

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ers are provided at one end with gripers to grasp the wire, and the other ends of the levers are operated by a screw rod to stretch the wires and draw the ends together.

Messrs. Joseph B Eaton and Charles Latham, of Shamokin, Pa., have patented an improved Machine for Cutting and Threading Pipe, which consists in a divided and hinged sleeve, having at its ends projecting rims for receiving the ends of a forked lever, which carry pawls for engaging ratchets carried by the rims. A thread cutting die is fitted to the sleeve, and the sleeve carries a leader for starting the thread.

Mr. James Keefe, of Port Eads, La., has patented an improved Fastening for Dredges, for connecting the backing chain with the dipper handle, to enable the dipper to be lowered to the bottom at the desired angle without its being necessary to throw the drum out of gear.

An improved Pump has been patented by Mr. Friederich A. Helmecke, of Round Top, Texas. The object of this invention is to furnish, for the purpose of sprinkling liquid poison on cotton plants, as well as for sprinkling and watering purposes, and for extinguishing fires, an improved pump of simple and effective construction, that may be operated with great facility, and used in connection with any suitable receptacle.

Correspondence.

Curious Suggestion for the Measurement of Stellar Distances.

To the Editor of the Scientific American:

I read with much interest your speculative editorial, a week or so past, on the possibilities of Professor Edison's new heat measuring instrument, the tasimeter.

Granting that it can be so sensitively made and adjusted as to detect a star by invisible radiations, then I would propose, for your criticism, an adaptation which I have not seen advanced heretofore, namely, for the measurement of distances of heavenly bodies from the earth.

If it is not already known, it would be a matter of comparatively easy experiment to establish a ratio of increase or decrease of indication on the scale of the instrument for a given temperature measured at regularly approaching or receding distances. For instance, the heat of the flame of a candle, being, say, 10° at 12 feet distance, will indicate on the scale, say, 9° of arc; removed to 15 feet, the indication will be, say, 8½°; and so on regularly for the increase or decrease of distance. So that if at the least distance from the instrument measurement is made of a heated object (which, if at a greater temperature than that previously ascertained, might be reduced to the necessary quantity), and measurement is then made at an increased known distance from the instrument, by the quantity indicated on the scale, with the law previously established, we might ascertain by mathematical formulæ the distance of the body from the point of observation. To illustrate, we will take the sun for example. Let one observer observe at exactly the mid-day meridian passage, and another, at the same instant of time, so far west of the first that the distance the observed ray has to travel is, say, one, two, or three thousand miles further, as the case may be, to the western observer than to the eastern; it being understood that observation is made at the same point on the sun by both observers; hence it will be seen that if the distance between the instruments is known, and the instrument sufficiently sensitive to detect the loss of heat by the passage through the larger space, we can then at once determine the distance of the sun from the earth, and bid farewell to slow coming transits.

To give an idea of the sensitiveness of the instrument required for such an observation, it is only necessary to state that, assuming the distance between the two stations of observation to be 3,000 miles, and the already known distance of the sun as about 95,000,000 miles, such an instrument, to detect a difference in the loss of heat, coming from a source so far distant, while traversing 3,000 miles, or 3-95,000 of the whole, must be able to detect the loss of heat for every inch of removal of a body distant half a mile from the instrument! Can it be done?

"It's a big thought to think;" and yet, if it is possible for the spectrum to pick up and photograph upon the eye the millionth part of a grain of matter, why is not this and more quite as possible?

Ascribing all honor to the inventor of this most wondrous instrument, putting new possibilities and grand thoughts into the minds of men, I am, JOHN THOMSON.

New York, August 24, 1878.

A Note from Mr. Edison on the Above.

To the Editor of the Scientific American:

Referring to the communication from Mr. John Thomson which you kindly sent me, I have every reason to believe that the tasimeter will do all that he proposes. It certainly is infinitely delicate, and its only limit seems to be in dexterity of manipulation. Last evening, while using the Thomson galvanometer, the spot of light went off of the scale when my hand was placed in line with the tasimeter standing at a distance of fifty feet away from the instruments.

Menlo Park, N. J., Sept. 4, 1878. T. A. EDISON.

The First Gold Payments.

To the Editor of the Scientific American:

We notice in No. 9, current volume, of your paper, a statement that the Yale Lock Manufacturing Company paid off in gold August 15. Being subscribers to the SCIENTIFIC AMERICAN, we would call your attention to the fact that we paid our May pay roll in gold. So far as we know, we made the first gold payment on pay roll of any manufacturers in the country. WILCOX, CRITTENDEN & Co.

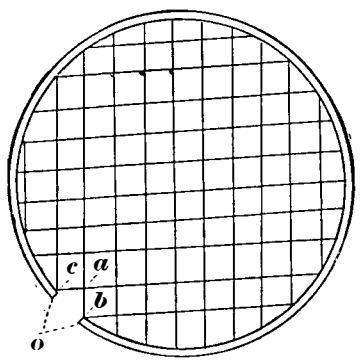
Middletown, Conn.

The Loss of Expansive Force of Steam at High Temperatures.

To the Editor of the Scientific American:

"Water and steam cannot be forced through narrow openings in the red-hot generator of a steam engine." Perham, in *Quarterly Journal of Science*, July–December, 1827, p. 471, also *Annal. de Chim. et de Phys.*, xxxvi., p. 435 (see *Silliman's Journal*, pp. 36–245), refers to the above principle as a well known fact, and in explanation it has been assumed that "steam, at a very high temperature, loses its expansive force." This does not seem a feasible supposition, namely, that heat, in certain degree, applied to water, renders it expansive, but in a greater degree it ceases thus to affect it.

Cannot this phenomenon be more satisfactorily explained? Referring to the accompanying engraving, representing a section of steam generator, having a narrow opening, *o*, I have drawn lines through this diagram equidistant and intersecting each other, as at *a*, *b*, *c*.



Let *a*, *b*, and *c* represent the molecules of water no longer divisible by heat, while the lines represent the repellent force of heat operating as inflexible rods. Now suppose the molecules of water to be separated, as at *c*, *b*, until two of them cannot pass through the orifice, *o*, abreast, then the repellent force of the heat will prevent the escape of the steam until the orifice is enlarged or the heat diminished.

If this be the correct explanation it follows that it would be no difficult task to ascertain the number of molecules of water, at a certain temperature, in a given space.

W. A. G.

The Spanish Language.

The Spanish language is derived from the Latin. It has preserved none of the various indigenous forms of language; of all the Latin tongues it is the purest, for it has taken nothing from the barbarian conquerors who overran Spain; and in spite of several centuries of foreign occupation, only a few foreign words have retained a place in the language; it is homogeneous. Much more Latin than Italian is, it does not disfigure its words either by elisions more or less arbitrary, or by illogical constructions, and its syntax is strictly laid down; it does not easily lend itself to the caprices of fashion or the whims of authors; it still remains what the sixteenth century authors made it.

Even in the Middle Ages the language of poetry was already formed, and required only the necessary lapse of time to polish it. Spanish literature flourished from that period, and Cervantes found ready to his hand the marvelous instrument which was to create the first masterpiece of really European literature.

The most singular feature of the Spanish language is its capability of being a perfect instrument at once for prose and poetry. In this respect it surpasses all others; Greek alone can be compared to it. As if this marvelous language were destined to be perfect in every way, it is as well adapted to the portrayal of the most vigorous passions as to that of the tenderest sentiments.

In prose, as in verse, the language shapes the idea, and, as it were, carves and moulds it. The great poet Villegas, had already, in 1500, adapted it to every variety of Greek rhythm and meter. Ercilla, one of the conquistadores, about the same time, wrote his epic poem "Araucana," in language as delicate and flexible as his own sword. Quiros, and Cervantes himself, drew poetical arabesques which throw the modern romantic school into the shade.

But let us leave these highly educated authors, distinguished Latinists, Hebraists, and Hellenists, and let us seek the fountain head, the unknown, popular, simple, uneducated authors, the romanceros (ballad singers).

In those times—more glorious, perhaps, than we think—whether war were carried on against Goth or Vandal, Saracen or King, the romanceros sang of everything—a romance of religion or love, a rustic song, a heroic deed, a ballad, civil or political history, celebrated paladins, noble ladies, provincial rights, liberty, famous palfreys, the Cid Ruy Diaz de Bivar and Ximena, Ogier and Durandarte. A fine and copious stream of poetry, drawn from the very fountainhead—the heart, the head, and the arm. What sap! what vigor!

History may break off, monks may impose silence, but history will live on in ballads—true, national history, the progress of civilization, exalted faith, *fueros* (charters), gallantry, chronology, sieges, dynasties, marches, and provinces, bishops and clergy, civil rights and canon laws, political life—all these the ballad treats of, and the language allows of it. Without a settled language it would have been impossible. We may judge of the glorious artists Spain possessed in those days when she outshone all Europe by the works they have bequeathed to us.

After the resplendent talents and literary genius of the fifteenth and sixteenth centuries came, alas! the wretched, passionless classicists; conventional poetry, more varied, more regular, assimilated the literature of Spain to her kings, swathed in etiquette, stiffened in ceremonial. It no longer attracts by its national vigor; poetical originality fades away; authors seek rather to imitate, to draw from Greek and Latin sources; impotent rules of poetic art can only supply lifeless forms, as is always the case where inspiration is wanting; art vainly seeks to support talent. All the works of these authors of the decadence have been preserved, and are still admired. Why? The language has saved them; it has given a body to the feeble idea, like those preparations which give substance and firmness to vaporous gauze.

Essentially poetic in character, being essentially dreamy and contemplative, the Spaniard still preserves his ancient gravity, and his language is the most solemn as well as the most poetical in Europe. It sings in a serious manner the subject which inspires it, and this seriousness adds to its grace. Strength, grace, and dignity are the principal characteristics which render it a language worthy to be spoken by the gods. E. OGIER.

[To the foregoing eloquent tribute to the literary merit and importance of the Spanish language, we may add the more prosaic, yet to American students and business men the more suggestive remark that the Spanish tongue competes with the English for the mastery of the New World. With the single exception of Brazil, the language of the South American States is Spanish. It is also the dominant language of the West Indies, Central America, and Mexico. These are our neighbors, and they furnish the nearest market for our surplus goods, as well as the sources of many of our importations. Every year draws the commercial ties between us more and more close, and every year makes a knowledge of Spanish speech more and more valuable to our manufacturers and merchants. During the coming winter evenings our young people will do well not to neglect the pleasures and profits of Spanish in choosing their studies.—ED.]

Optical Effects of Intense Heat and Light.

The following facts have lately come under my observation at the rolling mills at this place:

While looking at the eclipse of the sun July 29th, I handed the glass to one of the mill "heaters." He at once told me he could see as well with the naked eye as with the smoked glass. I then tried another "heater," and he at once repeated the same statement. I then went to the rolling mill and tested every "heater" at his furnace. They all told the same story. I hunted up every "heater" in the town except two (who were not found), over twenty in all, and every one declared he could see the phenomenon, and all its phases, as well or better with the eye unshaded. I took the precaution to test each one by himself, told him nothing of what I expected, or of the testimony of others. I made no suggestions to any of them, but let each tell his own story. All told the same tale; one peculiarity all agreed to—the image in the glass was upside down from what they saw with the naked eye. They would describe many peculiarities of color which could not be seen by others with the aid of the glass. It should be remembered that the "heater" has to see his iron in the furnace while it is enveloped in a flame whose intense glare prevents unskilled eyes from seeing anything, an education of the eye peculiar to this class of workers, as no other class of workmen is exposed to the same degree of heat or light.

I noticed as soon as the eclipse had progressed some time that I became nervous. I observed the same fact in many others about me. My wife at home did not think of the phenomenon at first, but became so nervous that she had to rush out of doors; she then saw the eclipse for the first time. I found this nervousness more in women than among men, chiefly in persons of debilitated frame, such as convalescents. Is this magnetic?

In accordance with your request, I repeated the experiment of Ericsson, and submitted a spherical piece of iron, eight inches in diameter, to a heat of over 3,000° Fah. It was carried to an almost melting point, withdrawn from the flame and placed on a stand. It had the appearance of a disk at all distances tried, up to over 100 feet. As seen by Mr. Hughes, the chief engineer of the mill (one of the most scientific men in his line in the West), myself and others, it was perfectly flat. The convexity did not appear; it was, while in this state, to all appearance no longer a sphere, but a disk. As the iron cooled off it resumed its original appearance of a sphere. Our mill men were much surprised by this phenomenon which they had been seeing all their lives, but till now had never observed.—*Joshua Thorne, M.D., in the Kansas City Review.*

TO FACILITATE the loading of heavy guns it has been found of advantage to enlarge the bore at the muzzles by half an inch or more, by turning out the metal to the depth of about two inches. The process is termed "bell mouthing," and is to be applied to all the guns in the English service of ten inches and upward.

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The Lontin Electric Light.

The electric light chiefly known to English visitors to Paris is the Jablochkoff candle, which displays its beautifully white glow from opalescent glass globes placed at a great height along the Avenue de l'Opéra and among the trees of the Orangerie. There is, however, another electric light used in Paris by the Chemin de Fer l'Ouest, for example, which has just adopted the Lontin system for lighting the Gare St. Lazare, the station at which the traveler by the Newhaven and Dieppe route enters the French capital. The Lontin light is now exhibited in London outside the Gayety Theater, and by comparison with its pure white radiance the gas lamps of the Strand appear to burn with a dull yellow glare. So far as the illumination of open spaces, streets, and houses is concerned, the future, supposing gas to be to a certain extent superseded, appears to lie between the Lontin and the Jablochkoff light. The Siemens light has proved of great value for the purposes of light-houses, where great intensity is desired. For ordinary uses, however, the problem is to moderate, not to increase, the intensity of the light. The Jablochkoff and Lontin lights have many points in common, and, as the former light has already been described, it is unnecessary to enter into all the details of this method of illumination. The points of importance in each are the generation of electricity by a machine, the distribution of the current, and the supply and regulation of the "candles." To the Jablochkoff lights the electrical force required is supplied by a Gramme electrical machine. The Lontin light is worked by a machine invented by M. Lontin himself. It produces at will a unique current or multiple currents, direct currents, and inverted currents. These can be distributed on several circuits. A great advantage in distribution is thus obtained. The machine produces several focuses of light, which can be entirely independent of one another. With a single machine 36 lights have already been produced. The motive force employed to produce a light equal to 100 Carcel burners is half a horse power. A Carcel burner is a conventional measure, the standard of which is a Carcel lamp burning 42 grammes of purified colza oil in an hour. The electric force having been produced by the Lontin machine is conducted toward the "candles."

In 1813 Sir Humphry Davy took two hot coals, put them in contact, and made a voltaic current pass through them. He then slightly separated them, and saw between them a bow of fire, which he called the electric arc. The "candles" of the Jablochkoff and Lontin lights are sticks of carbon representing the coal used by Sir Humphry Davy. M. Jablochkoff employs kaolin in addition to carbon in a very ingenious manner, but the main superiority which the modern manufacturers of electric lights have over Sir Humphry Davy is in the superior economy with which electric force is now elicited. The carbons are vertically placed, one above the other, in the Lontin light as in that of M. Jablochkoff. The light comes not only from the electric arc between them, but also from the carbon candles themselves, which become incandescent and are consumed. A clock work regulator advances them as they waste away, and it is stated that to such perfection has this contrivance been brought that for a week or more the lights at the Gayety have required no adjustment during the four hours for which they burn every night. Having once been set, the regulator has each night advanced the points without any aid from men. At Paris little accidents are not unfrequent with the electric light. The Avenue de l'Opéra is occasionally left in sudden darkness by some *contretemps*, and anything which renders this result unlikely to happen is, of course, an improvement. A Lontin light exhibited in experiments at the Paris Exhibition has remained luminous for 21 hours. The Lontin regulator and the Lontin machine are, it will have been seen, the specialty of this invention.

The lights at the Gayety are worked by a steam engine in the *Echo* office. For the display of the light as a novelty in a shop window a small gas engine would probably supply sufficient motive force to bring the Lontin electromagnet into vigor. The wires which convey the current pass under the road to the theater, and might be prolonged to Charing Cross, for instance, and Covent Garden Theater, so that all three points could be lighted at once by the same machine. The advantages which this, like the other systems of electric lighting, possesses over gas have been summarized as follows: Gas emits a fetid odor; the electric light is without smell. Gas may occasion explosions and fires; the repairing of the pipes is often difficult; great heat is developed together with the light; the flame is always colored even when gas has been completely purified. In the transmission of the electric light the pipes are replaced by wires; the voltaic arc diffuses very little heat (the hand may be held with impunity 12 inches above the Gayety lamps), and the light attained is white, perfectly compounded of all the colors in the spectrum, like sunlight. Indeed, it is so white that spinners and dyers can utilize it for sampling their stuffs. It may be added that the appearance of the lamps when sufficiently roughened glass is used is very beautiful.—*London Times.*

Canning Fruit Cold.

A lady in Springfield, Mass., according to the *Union*, has been making some experiments in putting up canned goods without cooking. Heating the fruit tends more or less to the injury of the flavor, and the lady referred to has found that by filling the cans with fruit and then with pure cold water, and allowing them to stand until all the confined air has escaped, the fruit will, if then sealed perfectly, keep indefinitely without change or loss of original flavor.

The Sewerage and Irrigation Farm at Bedford, Eng.

In a thickly populated country like England, the uniform removal of offensive matter from the dwellings is of immense importance. The health, comfort, and decent habits of the inhabitants are mainly preserved by the regular removal of excreta and other impure feculent accumulations from their habitations. For such salutary purpose no method that has hitherto been devised has succeeded in an equal degree with the water closet system, combined with well arranged sewerage, and a proper disposal of the effluent contents. Yet many towns are still deficient in sewage appurtenances, and pollute their brooks and rivers with the noxious refuse of their imperfect drainage. It becomes, then, important to inquire respecting the sewage contrivances of such places, where they have been already most elaborately and successfully executed, with a due consideration in what respect they may have been imperfect, with suggestions for improved methods, the expense of their construction, and the average cost of their maintenance.

In the town of Bedford a system of water, sewage, and irrigation works has been in operation for the last ten years which has been attended with satisfactory results. Previously, some imperfect drains polluted the beautiful River Ouse, and the greater part of the houses had offensive middens and cesspools. The town is in many respects unfavorable for drainage, lying low in the Ouse Valley, and being deficient in declivities. The fall in the lower parts is very limited, but the disadvantages have been successfully surmounted. The plan consists of a main sewer into which, from all parts of the town, lateral drains are discharged, and at the terminus of the main sewer it empties itself into a tank 16 feet deep, so that an artificial fall is obtained, from which it is pumped up, and distributed by pipes over the irrigation farm, which consists of about 180 acres. The pumping and irrigation works are distant a mile from the town.

The population of the town is about 19,000, and from the water works receives daily 350,000 gallons of water; the greater part of this, of course, passes from the houses and streets into the sewers, which, in addition, take a considerable quantity of subsoil drainage, making together about 700,000 gallons daily to be pumped up, and distributed over the farm. So much of the subsoil drainage passing into the sewer is owing to the main drains not having been made water tight, which is certainly a defect, for a subsoil drain, and a sewer when properly constructed, are not convertible. The sewers are intended to convey offensive fluids and excremental matter from our habitations, the ultimate disposal of which, and its transformation to an innocuous state, has been considered a question of difficult solution. The subsoil drain is intended to convey from the land the surplus water that it may receive, and it may properly be discharged into and supply the regular water courses.

So large a quantity of water passing into the sewers causes the manure to become excessively diluted, and, as a liquid manure, it does not contribute so much richness to the soil as many suppose; and what fertilizing matter it does impart to the land is soon exhausted by the rapid vegetation. The great value of the irrigation is not so much for the solid matter held in solution, as maintaining a constant and sufficient supply of moisture in the arid seasons. So far from land irrigated with sewage becoming surcharged with manure, to keep it in good condition it will bear a considerable quantity of solid in addition.

A subsoil drain should be made of porous bricks or tiles, to allow the water to percolate through them, so as effectually to carry off the moisture with which the ground may be overcharged; but a sewer should be perfectly water tight, as the quantity of water thrown down our closets, and discharged after domestic usage, will render the contents of our sewers sufficiently fluid. Beyond this, for purification or clearing away obstructions, occasional flushing will accomplish all that will be required.

The land, being near the town, is heavily rented. In such situations it is everywhere let at, what is called, accommodation price, being often required for purposes which are not expected to yield a direct agricultural profit. The average rent—it is rented of several landlords—is about five pounds per acre; but it is very suitable for the purpose, being on a bed of gravel, and the sewage water is rapidly absorbed by the soil. Excepting in very rare instances, no unpleasant smell can be observed on going over the farm, as the sewage, passing immediately into the ground, at once becomes deodorized.

The sum expended in engineering works, buildings, pumping apparatus, and embankment was £25,000, which was borrowed, to be repaid with interest by half yearly installments running over 35 years. It would be unreasonable to expect any portion of this sum to be obtained from the profits of the cultivation, as, although directly paid out of the rates, the public is fully remunerated for the outlay by the important benefits conferred. Previously to the establishment of the sewage works, each housekeeper was at considerable expense in the removal of the offensive refuse matter, which may be considered a fair set off against the increased assessment, besides the improved healthiness of the town, and its having a clear magnificent river flowing through the town, instead of a stream turbid with various pollutions.

The production of the land has been extraordinary, and it is admitted that on no irrigation ground have more luxuriant crops been obtained. The Italian rye grass, mangel-wurzel, and cabbages have been a great success, and the root crops generally have been distinguished for obtaining prizes at many agricultural exhibitions. Potatoes, parsnips, and other succulent crops have been cultivated with equal success. The produce has been sold by auction, and has generally realized good prices. For a public body this method of disposing of the crops is, perhaps, the most satisfactory, although a private individual might possibly turn them to better account.

During the last two or three years farming has been generally unremunerative, and the Bedford farm has only paid the rent and expenses of cultivation; but this has not been doing amiss, considering the charge for rent—altogether £928 10s. per annum. For irrigation cultivation, a dry season must always be the most successful. Italian rye grass and roots being the principal crops, and the demand being at such times very considerable, good prices are always realized. The produce sold by auction, and privately by the manager, amounted altogether in the year ending last December to £1,751 10s., and in addition a portion of meadowing was sublet at a rental of £119 17s. In favorable seasons we may fairly calculate upon obtaining, with all our disadvantages, a considerable profit.

In the tank, rags, paper, and other solid articles are intercepted by a simple grating; and the sewage is then pumped into a cast iron tower seven feet in diameter and twelve feet in height, from which, by gravitation, it is distributed over the farm. It is first conveyed through covered piping to the land, and over twenty acres along ridges by a 9 inch half round drain tile, which is sunk into the ground. The ridge is twelve inches above the furrow, and the sewage water running over the tile sinks into the land, very little reaching the bottom. The other fields are less carefully laid out, but are watered in like manner from surface furrows along the higher lines; heavy crops are regularly grown.

The effluent water percolating through the banks on the side of the land is perfectly clear and tasteless, and, so purified, passes into the river.

Two engines, of 12 horse power each, and two centrifugal pumps, are employed at the pumping works.

The length of the main sewer exceeds a mile and a half, sufficiently capacious to serve as a reservoir during the night, and has a storm overflow, with a self-acting flap. An excessive rainfall will pass without trouble in the night into the river.

WATERWORKS.

To complete the sanitary arrangements of the town, water works were indispensable, and accordingly formed part of the system. A good supply of excellent water was obtained by sinking a well about half a mile distant, 40 feet deep in the oolitic limestone. This water is thrown up by pumping into a covered reservoir at the top of a hill in the neighborhood, and is raised 170 feet above the general level of the town, and gravitates through pipes to supply the inhabitants. The pumping is performed by two engines, which work alternately; one is nominally of 40 and the other of 60 horse power. The cost of the waterworks, piping, and all appliances connected therewith, amounted, in the first instance, to £19,600, but various additions and extensions that have since been made have increased the expense incurred to £24,000. This outlay, although it may seem large, considering the extent and importance of the works, has been very economically carried out, and has been a lucrative investment. At this time the gross income per annum derived from them is no less than £2,028, which leaves a fair profit after deducting the interest of the capital, £1,080, and £700 working expenses.

The expense of these works has necessarily caused a considerable increase of the rates, and will continue to do so until the repayment of the loans shall have been completed, when a permanent benefit and fixed capital will be secured. The cost is by no means to be regretted, as the advantages are more than commensurate with the outlay. The comfort of the inhabitants being greatly improved, and the healthiness being permanently secured, the mortality of the town, according to the last returns, was little more than 19 to the 1,000 of the population, which is below the average of the country.

Dr. Prior, the Medical Officer of Health, in his report for 1878, remarks that—

"Bedford has now reached a point at which it has come to be regarded as one of the best sewered, best appointed, and most healthy and agreeable towns of England. It is visited for the purpose of obtaining particulars as to its management by many strangers—sometimes from foreign countries."—*Journal of the Society of Arts.*

FOR stopping holes in castings, or for covering scars, a useful cement may, it is said, be made of equal parts of gum arabic, plaster of Paris, and iron filings, and if a little finely pulverized white glass be added to the mixture, it will make it still harder. This mixture forms a very hard cement that will resist the action of fire and water. It should be kept in its dry state and mixed with a little water when wanted for use.

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A New Feature in Puddling Furnaces.

The London *Mining Journal* describes a recent English invention for economizing fuel in puddling, heating, and steam generating furnaces, which consists in making openings in the smoke stack, and in the sides of the furnace near the fireplace, and connecting them by pipes or tubes, furnished with valves or dampers for regulating the passage of gas.

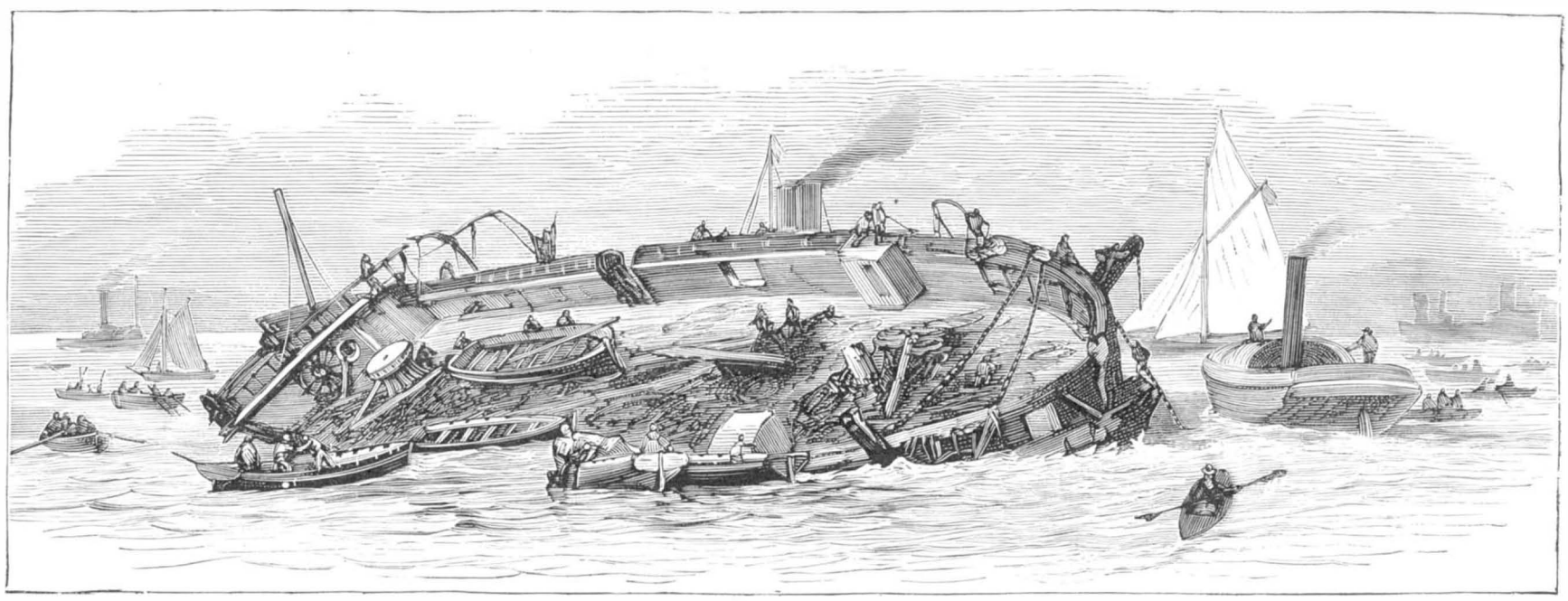
By the combustion in the furnace a powerful ascending current of the products of combustion and gaseous matters from the furnace is produced; this gaseous current, when the damper at the top of the stack is raised to its full extent, passes into the atmosphere, but when the damper is lowered so far as to obstruct the ascending current, part of it descends the tubes described, and, re-entering the furnace, any unburned gaseous fuel contained in it is burned. Considerable economy in fuel is claimed for this method, and complete control over the working of the furnace.

The return to the furnace of the products of imperfect combustion, which are produced in large quantities in the process of puddling iron, should, we think, effect good economies; but we question if these products could be induced to return to the furnace simply by the closing or partial closing of the damper on the stack, for the more the damper is closed the less powerful becomes the furnace draught, upon which the return flow of the gases depends.

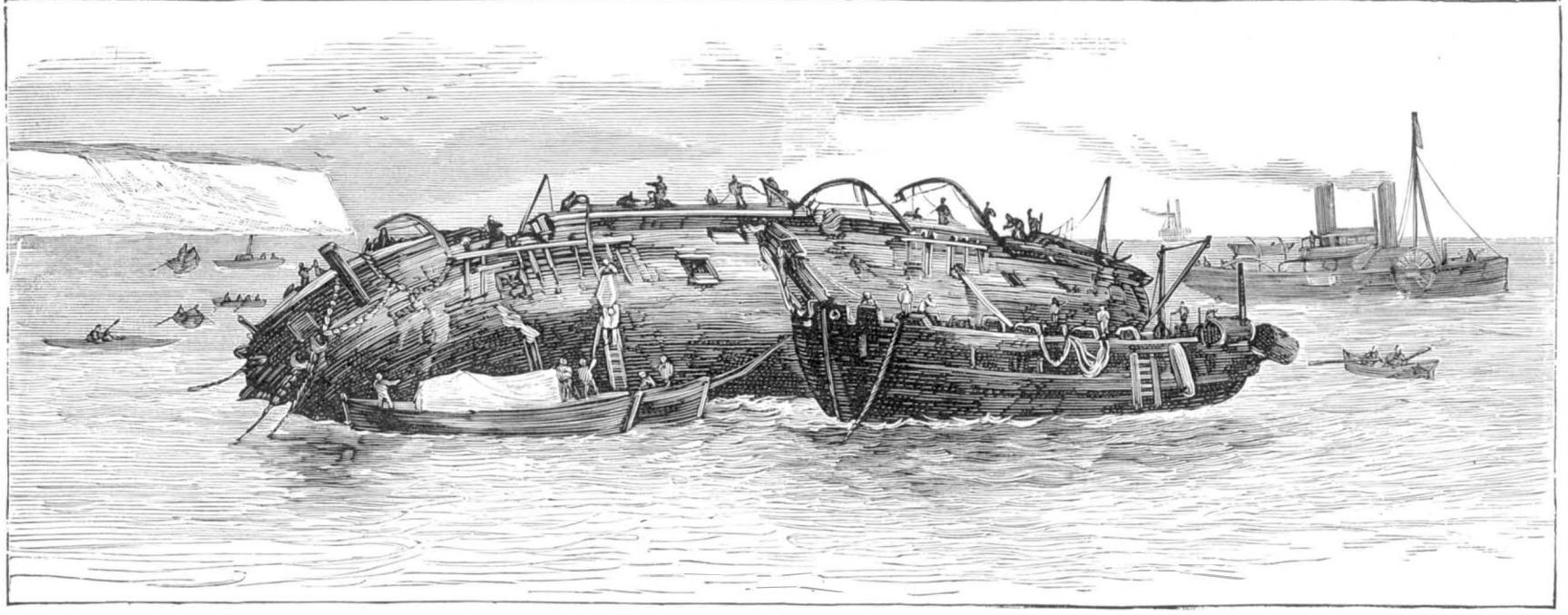
This precise method was patented here in 1870, but with the added improvement of an exhaust and force fan for withdrawing the gases from the stack and returning them through the fireplace. Probably this has been laid aside to await the returning prosperity of the iron industry.

THE RAISING OF THE EURYDICE.

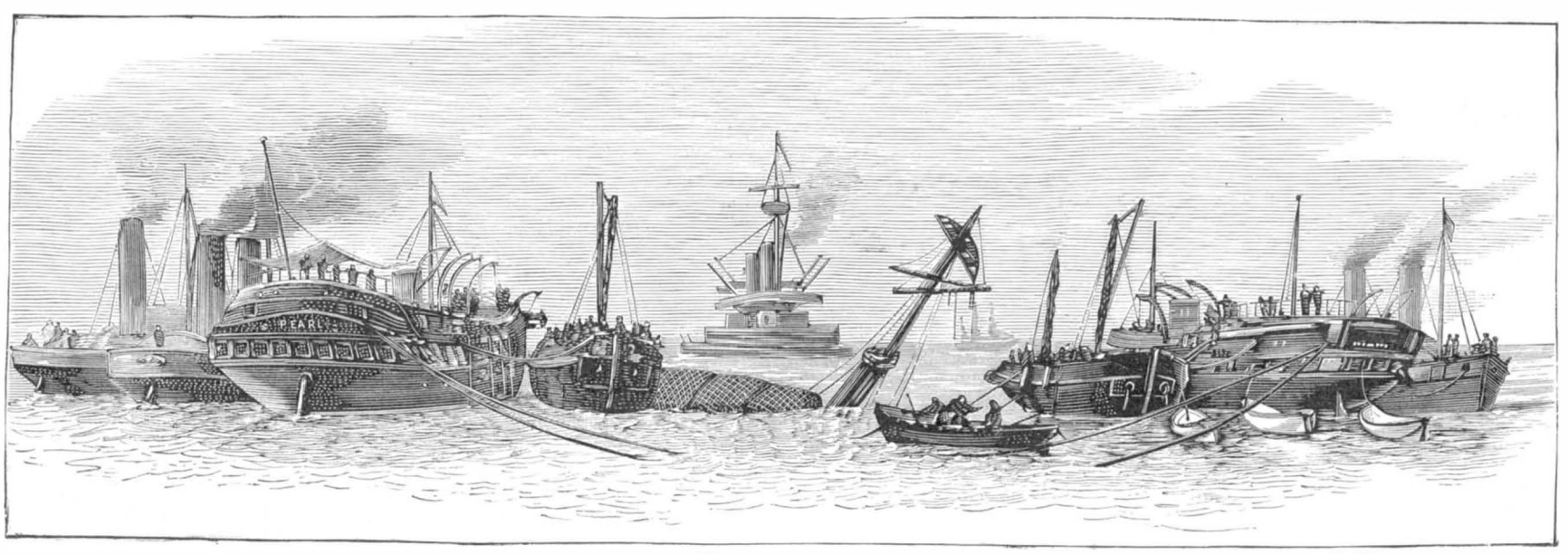
After four months of arduous labor, the wreck of H.M.S. Eurydice has been successfully beached at Sandown Bay. The positions of the vessels employed in the lifting process are shown in the engravings and in the accompanying diagrams, a reference to which will enable our readers to understand the somewhat complicated arrangements which were necessary for the accomplishment of the work, which has all along been of the most difficult character. One great point must be borne in mind, that everything depended upon the divers, and that they could only work at slack tides and in very fine weather, the under currents on the Isle of Wight coast being exceptionally strong. The ship lay at first in seven fathoms and a half of water, and to this must be added eight or nine feet of mud in which the wreck was embedded, making in all a depth of about fifty-six feet from the surface. Wire ropes were from time to time attached to the inner sides of the ports by means of "toggles," pieces of timber six feet long by twelve in diameter, which acted as buttons; the other ends of the ropes were made fast to the four floating hulls placed over and across the Eurydice; and, when everything was ready, and the tide at



RAISING THE EURYDICE.—THE WRECK BEACHED IN SANDOWN BAY—DIVERS CLOSING THE LEE PORTS.



PORT SIDE OF THE EURYDICE AFTER THE LAST LIFT—REMOVING THE BODIES.



Pearl. Swan. Popoff Bag. Thunderer. Wave. Rinaldo.

METHOD OF LIFTING THE WRECK OUT OF DEEP WATER.

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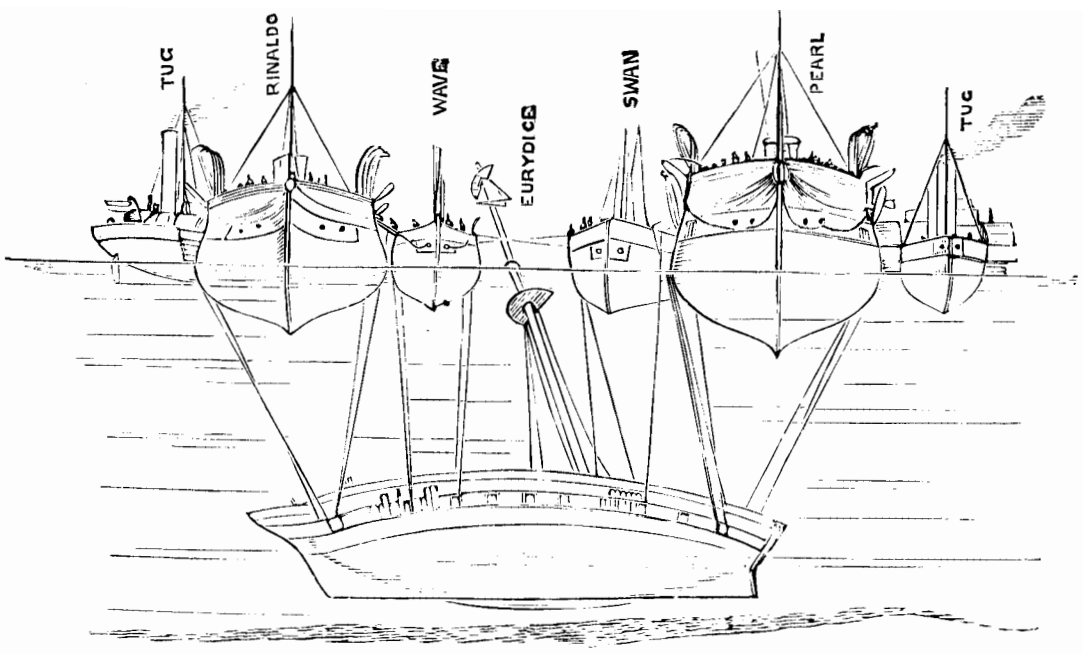
its lowest ebb, the process of pinning down was commenced —that is, the ropes were hauled taut, and made fast to the lifting vessels, so that, as the tide gradually rose to its highest point, the whole mass of lighters with the sunken vessel lifted as well. Then it was that the steam tugs took up their positions, and towed the ill-fated craft toward shallower water, till she was left on a bank under the Culver Cliff, with one side and her upper deck above the water at low tide. Many times all would be ready for lifting, when the sea roughened and everything had to be abandoned, the lighters returning to Portsmouth.

The deck of the vessel, when beached, presented the utmost confusion, the whole surface being almost covered with ropes; the hull, with the exception of the bows, carried away by the Thunderer, and a portion of the quarter, torn by the iron ropes, was but little damaged; and two boats, in an undamaged state, were found almost in their proper places. More than a dozen bodies were found, but many a score remain below. The last lift was effected by means of steel hawsers passed under the wreck.



THE LIFT BEFORE THE MAST WAS OUT—LIFTING VESSELS ATHWART SHIPS.

Cast Steel without Crucibles.

A new method of producing cast steel, which dispenses with fusion and conversion in crucibles or melting pots, has recently been brought to public notice. On account of the superior cheapness and quality of the metal, the articles are preferably manufactured from Siemens-Martin or Bessemer steel, rolled or forged into the required form, then, finished as to shape, they are placed in iron boxes, and recarbonized by the ordinary cementation process.

It is probable that the repeated heatings and workings of the metal during the process of shaping the article so thoroughly expel the occluded gases, the retention of which in the iron invariably creates blisters in all other cemented steel, that a smooth and uniform surface may, in many instances, result; but though this method may be exceedingly economical for the production of a certain class of small articles, it may reasonably be doubted if the character of the grain of the steel can be under perfect control, and whether the process would apply to manufactured articles of any considerable size, or to those of unequal thickness of parts.

Experiments in the manner of packing, however, may determine that some of these objections may be overcome.

New Inventions.

An improved Machine for Stretching, Dipping, and Drying Fabrics has been patented by Mr. John D. McLean, of New York city. The object of this invention is to furnish an improved machine for straightening, stretching, and spreading fabrics in handling and finishing them.

Mr. Charles W. Blake, of Lyndon, Kan., has patented an improved Machine for Attaching Paper Fasteners, particularly the well known McGill fasteners. This device has a spring portion, carrying at the lower or base part a guard for the paper, and a bed plate with rear recess for the slitting knife, and front groove or seat for the fastener, and at its top part the slitting knife, hammer plate, and spreader.

Mr. Daniel L. Holden, of Philadelphia, Pa., has patented an Apparatus for Curing Meat by a circulating current of refrigerated pickle. It consists in the improved arrangement of pipes and tanks for securing an economy of time and labor in the manipulation of the meat and pickle.

An improved Bottle Corking Machine has been patented by Mr. J. C. M. Braun, of Baraboo, Wis. This invention relates to an improvement in that class of apparatus for inserting corks into bottles by which the corks are compressed in a funnel or tapered tube, and forced through it into the necks of the bottles by means of a plunger, which is operated by suitable devices.

An improved Vehicle Wheel Hub has been patented by Mr. George Bartlett, of Gananoque, Ontario, Canada. The object of this invention is to furnish a strong and easily attachable hub for the wheels of vehicles, the application of which will insure a true wheel.

Mr. Henry L. Mennerich, of Sioux City, Iowa, has patented an improved Horse Collar, having loops for attachment of the hames, whereby the usual hame rim on the collar is dispensed with and the hames may be adjusted. The collar is formed in two parts, buckled together at the top, and when on the horse it is held together at the bottom and in place by the hame strap.

An improved Tobacco Hoister has been patented by Mr. John M. Wadlington, of Upton Station, Ky. The object of this invention is to furnish an improved device for hoisting green leaf tobacco into place in the drying house.

Messrs. Julius Sues and Sylvester W. Raplee, of Louisville, Ky., have patented an improved Children's Carriage. This invention covers improvements in children's carriages by which the back may be changed in a very simple manner from an upright to a reclining position. The carriage is thus readily converted into a bed, giving in either position a complete and comfortable support to the child's body, with the advantage that all the parts remain within the body of the carriage.

Mr. John A. Brown, of Tyler, Texas, has patented an improved Copying Roller, for the purpose of moistening the leaves of letter books to take impressions, so as to dispense with the hair brush and other devices used at present. It admits of taking a large number of impressions without being dipped into water as with a brush.

An improved Life Boat has been patented by Mr. Frank Dunn, of Gloucester, Mass. This invention has for its object, first, to provide for sea-going vessels a life boat which will be light, strong, capacious, and safe, and which may be propelled by oars or a sail; and, second, to provide means for safely and expeditiously detaching such boat from the ship, which detaching apparatus will permit the boat to be compactly stowed on the vessel in such a position that the passengers may enter the boat without danger of getting overboard.

An improved Metallurgic Gas Furnace has been patented by Mr. Carl Gröbe, of Berlin, Prussia. This invention is an improvement in that class of gas generators for furnaces, or in iron smelting or puddling gas furnaces, in which the gases evolved from coking coal are caused to mingle with the gases of combustion in the fireplace, and they are together forced into and through the iron smelting or puddling chamber.

Mr. Sylvester W. Sheldon, of New York city, has patented a Removable Cover for Barrels, and it consists in a cover made in three hinged sections, one of which is provided with a clamping device for securing it to the barrel, and the other two are arranged to fold together, and also to fold upon the fixed portion.

An improved Shoulder Pad has been patented by Mr. Gottlob J. Scheu, of Washington, Pa. The object of this invention is to furnish for ladies' and gentlemen's garments an improved adjustable shoulder pad, which is to be used in place of padding at the shoulders, to impart a better fit and a firm, square build at the shoulders.

Mr. William G. Fink, of Minnesota City, Minn., has devised an improved Wagon Brake, which is so arranged that the driver can apply the brake with his foot, leaving his hands free to guide and control his team, and so that the brake lever will be entirely out of the way in getting into and out of the wagon and in loading and unloading it.

An improved Vapor Bath has been patented by Mr. Geo. W. Carpender, of South Bend, Ind. This invention relates to an improvement in electro-thermal medicated baths, designed to apply steam, electricity, and medicated vapors, either separately or conjointly, for the cure of diseases.

Mr. D. L. Holden, of Philadelphia, Pa., has patented an improvement upon that feature of an Ice Machine known as the Congealer, or apparatus in which the congelation of the water is effected. It relates more particularly to that form of congealer in which receptacles containing a cold non-congealable liquid are immersed in a tank of pure water, so as to freeze upon the outside of said receptacles blocks of ice without incorporating the impurities of water.

Mr. John Barth, Jr., of Evansville, Ill., has patented an improved Insecticide, composed of cassia, carbonate of ammonia, camphor, and bicarbonate of soda.

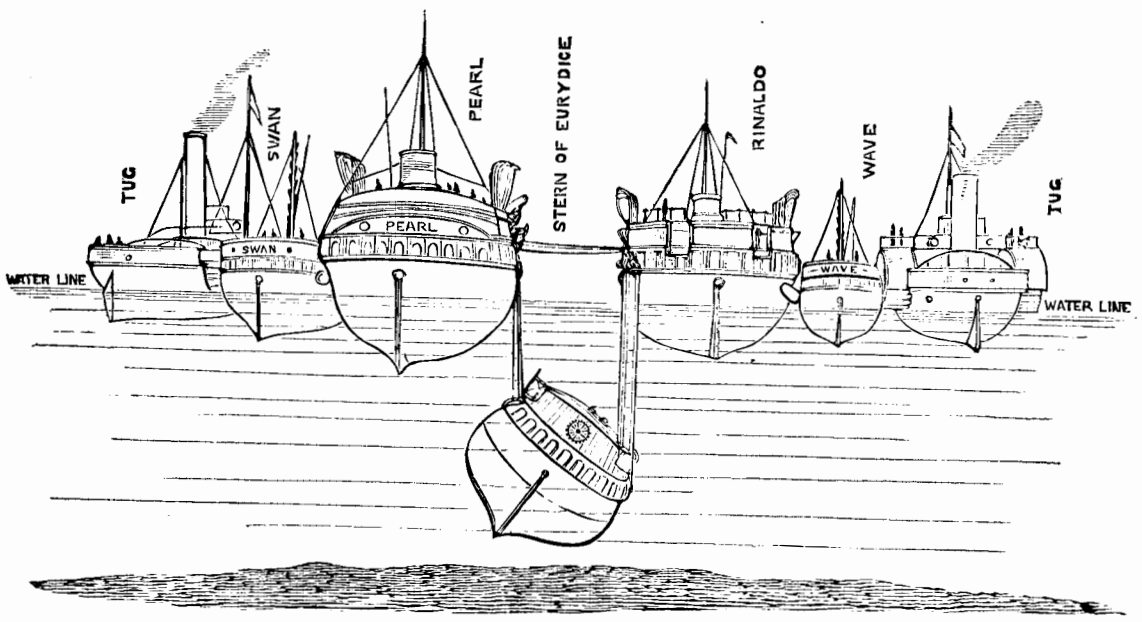
Mr. Samuel B. Shultz, of Princeton, Ill., has patented an improved Washing Machine, which will wash clothes quickly and thoroughly, and will enable any parts of the clothes which are soiled more than others to be especially rubbed. It will allow the dirty water to readily flow away from the clothes, and will adjust itself to any unevenness in the thickness of the clothes being operated upon.

Mr. Enoch Prouty, of Boscobel, Wis., is the inventor of an improved Cylinder Printing Machine, which is adapted as well for newspaper work as for job printing, admitting the printing of large and small sheets with equal facility, and being therefore specially adapted for smaller offices in which printing of great variety has to be done.

Messrs. David Wickersham and Thomas B. Brown, of Fairfield (New Waterford P. O.), Ohio, have patented an improved Machine for manufacturing Basket Splints for making quart berry-baskets and other small baskets. It is simple and convenient, and will form the splints rapidly.

Mr. George S. Snell, of St. Louis, Mo., has patented a simple and reliable Door and Safe Lock, in which no springs are used, the bolt, tumblers, and necessary catches being actuated by the force of their own gravity.

Mr. Robert R. Moore, of Lewisville, Ark., has patented an improved Vehicle Axle Lubricator, which consists in certain novel details of construction, arrangement, and combination of a thimble skein, an oil reservoir, and devices employed in connection therewith, whereby provision is made for attaching and removing them, for holding them securely when in place, and for insuring the proper working of the parts.



STERN VIEW OF LIFTING VESSELS AND WRECK—THE MAST TAKEN OUT TO AVOID CONTACT WITH SHIPS.

Mr. Clinton Stevenson, of Southwest Oswego, N. Y., has patented an improved Hay Rack, which may be applied to a wagon for use in loading hay, and when not desired for use may be readily taken apart for laying away in a compact form. It consists in connecting the parts of a hay rack together by dovetail joints and mortises, and in such a manner that the removal of the wedges which bind the main frame will permit the parts of the rack to be separated.

Mr. Elie Martin, of Paris, France, has patented an ingenious Automatic Swimming Figure or Toy which will go through the motions of swimming with facility.

Messrs. Joseph M. Searle and Gideon G. Palmer, of Stanhope, N. J., have patented an improved Rotary Exhaust Cylinder for Steam Engines, in which a positive exhaust is obtained at any or all points of the cut-off, as the exhaust ports remain open during the entire return stroke of the piston. After the steam is exhausted the exhaust ports stay open until the piston makes the entire length of its stroke, so as to get the full benefit of the expansion, and do away entirely with back pressure.

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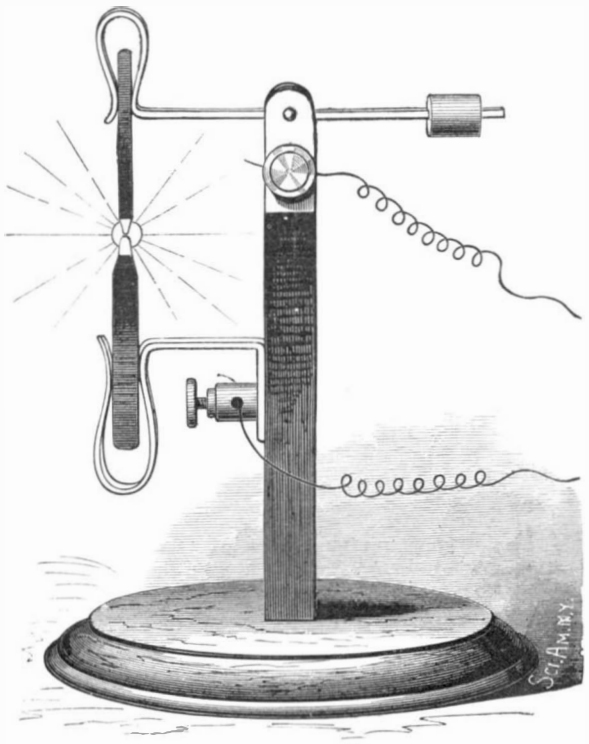
SIMPLE ELECTRIC LIGHT APPARATUS.

BY GEO. M. HOPKINS.

The engraving represents, full size, a very simple and easily constructed apparatus for producing an electric light on a small scale. To the center of the wooden base is attached a vulcanite standard, to one side of which a spring carbon holder is secured by the binding post, which screws into the standard. Two brass ears, having apertures for receiving the pivots of the upper carbon holder, are secured to the upper end of the vulcanite standard.

By placing in the U-shaped loop at the end of each holder a small pencil of battery carbon, and adjusting the holders so that the points of the carbons touch, and connecting the instrument with a battery of 4 or 6 Bunsen cells, a small but very brilliant light will be produced.



SIMPLE ELECTRIC LIGHT APPARATUS.

As the points burn away the upper carbon moves downward of its own gravity. The contact of the points, which should be light, is regulated by a movable weight on the straight end of the pivoted holder.

Town Sewage Changed into Hydraulic Cement.

In May, 1872, General Scott read a paper before the Society descriptive of a method of dealing with sewage precipitates, and then described how, by means of fire, the sludge deposited, after precipitation by lime, could be converted into strong and salable cement. That purification by lime will produce a clear effluent, and one which, thrown into a river of sufficient volume, will insure a satisfactory result, is admitted by Royal Commissions and leading chemical authorities, but the great difficulty remaining has ever been how to deal with the vast accumulation of sludge that necessarily takes place. In some cases, as at Birmingham for instance, it costs the town £14 per acre to dig it into the land, which the corporation has secured in connection with its sewage works, while at Leeds and other places it has been a source of great trouble to get rid of at any price. General Scott, however, discovered that the sludge, when dried, contains in it sufficient combustible material to act as a fuel for burning it; and he thus, at a moderate expense, converts the sludge into a powerful and useful cement of the character of Portland or Roman, according to the constituents of the sewage from whence it was derived. Repeated experiments on a more or less extended scale showed the practicability of the process. A few days since a large party, consisting of the Mayors of Burnley and the neighboring towns, with the chairmen and members of sanitary authorities in Lancashire and Yorkshire, met together, by invitation of Scott's Sewage Company, to inspect the works lately erected by the Corporation of Burnley, Eng., for carrying out this process on an extended scale for dealing with the sewage of Burnley.

The Corporation of Burnley was prohibited by injunction from allowing the effluent from their sewers to flow into and pollute the River Calder. The Corporation and Scott's Company entered into a contract whereby Scott's Company engaged to produce and have produced a clear effluent. The injunction has been got rid of, and the Corporation has recorded its satisfaction at the results which the company has attained. The works at Duckpits, a short distance from Burnley, have been erected by the Corporation, after the designs of Mr. W. B. Bryan, C.E., which exemplify the latest scientific views on the subject, in order to deal with all the sewage of the town and district except in time of floods. The Corporation deliver the sewage into the tanks, and then Scott's Company purifies it by lime precipitation, to be supplemented eventually by filtration, through coke if required. The clear effluent passes into the Pendle water which joins the River Calder. The stream into which Colne and Barrowford, Nelson and Brierfield pour their raw sewage is at present unpurified. The Calder below Duckpits also receives a considerable amount of sewage before it joins the Ribble. Duckpits thus placed, as it were, between two sources of impurity, presents a case of some difficulty. How it is met on the Pendle water is shown by the pure effluent discharged into it. The sludge, always an offensive difficulty, is entirely cleared away by its conversion into cement (Portland and other hydraulic and Roman cements). All that has hitherto been made has been sold or used in the works. The cement is sold with a guarantee as to the strength and quality. The company is open to make contracts with any other sanitary authority. The nature of the contract and the cost of working the process depend on local circumstances.

The sewage from the town passes into four settling tanks, after receiving the proper dose of lime cream previous to entering them. After settlement, the time for which varies from a few days to a fortnight, according to circumstances, the sludge is pumped into draining and drying "backs," from whence it is dug out and carried to a heated drying floor. When sufficiently dry it is packed into kilns and burnt, the only fuel used beyond that which it contains being a small amount of coal and shavings to set it alight. At the end of a few hours the kiln is drawn, and the "cement clinkers," as they are termed, are ground into a coarse powder, which forms the cement. The cement is readily salable as Portland or other hydraulic cement, according to the character and treatment of the sludge. It is understood that these are the first works on a commercial scale for carrying out the process. The Corporation are satisfied with the effluent, and the company feel assured that the results of working up to the present time are a money success.

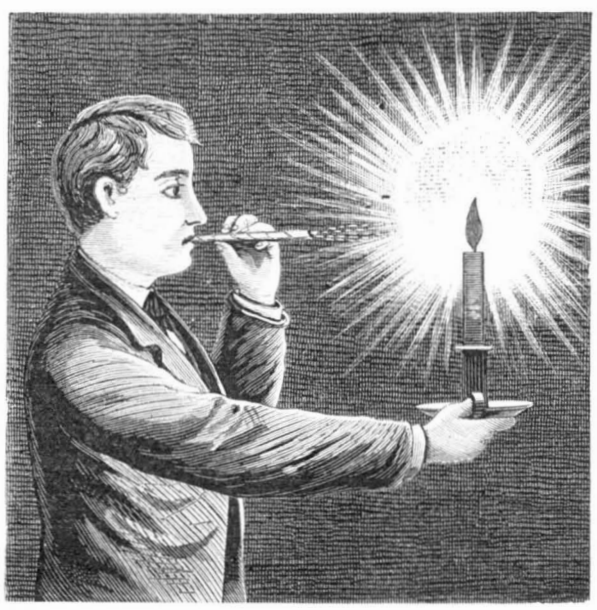
Eau de Cologne as a Peace Maker.

The Rev. H. C. McCook has given to the Academy of Natural Sciences in Philadelphia an account of some experiments he has made to determine the mode of recognition among ants. The pavement ants (*Tetramorium cæspitum*), for example, are very quarrelsome, and fight like human savages whenever members of different colonies meet. They challenge all comers. If friends, they pass on; if foes, they interlock antennæ, and "have it out" on the spot. Mr. McCook thinks that they recognize friends and foes (as some savages do) by the sense of smell; and he has made the curious discovery that when fighting factions of these ants are enveloped in an atmosphere of eau de Cologne, they instantly become friendly; a truce is declared, and these natural enemies go on together for several days amicably feeding, burrowing, and building. We infer that the truce holds so long as the peace compelling atmosphere is maintained. Carpenter ants, on the contrary, are not amenable to this treatment, but go on snipping off each other's heads without regard to their fragrant surroundings.

Philanthropists may possibly find a pregnant hint in these observations. Who knows but it may be possible to discover eau de Cologne adapted to allay human passions; so deftly compounded that a bottle or two broken over the heads of rival factions (say on the 12th of July, or in a Bulgarian village) would insure instant amity?

INTERESTING EXPERIMENTS WITH LYCOPODIUM SEEDS.

The seeds of the *Lycopodium clavatum*, or club moss, are so fine that they appear as a yellow powder, and repel water so powerfully that a person may thrust his hand below the surface of water that has been well sprinkled with it without wetting his hand. This property renders it useful as a preventive of chafing in infants, and as a coating for pills to prevent their sticking to each other.



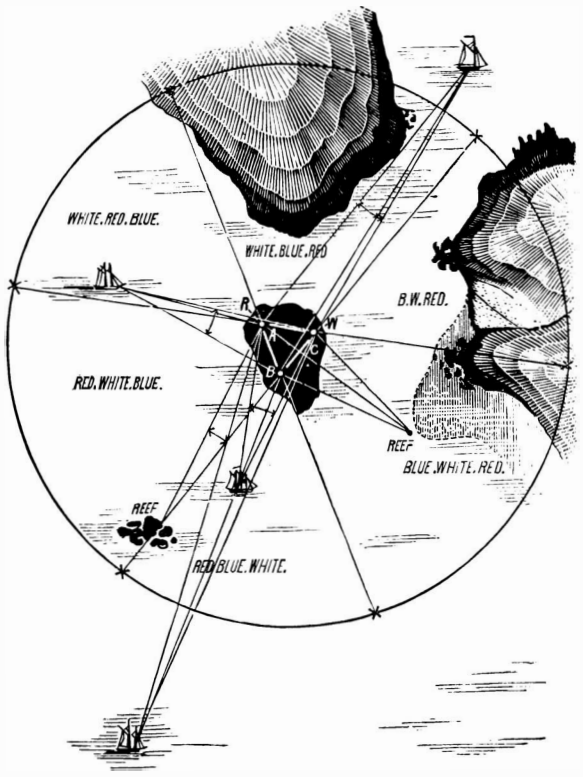
It has another curious property: if a teaspoonful of it be placed in a saucer, the flame of a common match will not light it; it appears to be as incombustible as table salt; but if a small quantity of it be placed in a short paper tube and blown over the flame of a candle in a cloud, as shown in the engraving, it will burn with a flash like gunpowder, affording a good illustration of the dangerous explosive that is formed when carbonaceous dust is mingled with a certain proportion of air; and shows the necessity of reliable means for the removal of such dust from flour mills, and other manufactories where it is liable to accumulate.

There seems to be good ground for supposing the recent terrible explosion and burning of the flour mills at Minneapolis, Minn., were due to the presence of mill dust.

METHOD OF DETERMINING THE POSITION OF VESSELS.

Mr. P. A. de la Nux, of Haulei Kauai, Sandwich Islands, sends us the following very ingenious method of determining the position and distance of vessels as they approach the coast.

The lighthouses can at present only be used for the position of vessels by an inspection of the compass, while the distance is obtained by the height above the horizon. Frequently, however, the compass is not reliable, and especially near the coast, and also at night the horizon is distinguished only with difficulty. It cannot be observed at all if an island or other piece of land is between it and the vessel. The lighthouses lose, therefore, in utility the nearer a vessel approaches the land.



METHOD OF DETERMINING THE POSITION OF VESSELS.

The following method may be employed to fix positively the position and distance of a vessel:

A B C are three lights of different colors, which are preferably double lights, so as not to be confounded with stars. They are placed on the angles of a triangle at the entrance of a harbor or passage, in such a manner that their rays extend over as large a circular space as possible.

It is evident, by reference to the illustration, that no two positions of a vessel can give the same angles. The position of the vessel is then readily determined by the order in which the colors of the light are seen, as thereby the sector is given in which the vessel is situated. The distance of the light indicates in what part of this sector the vessel is, while finally the size of the angles formed by lines drawn to the lights furnishes the exact distance of the vessel therefrom. The shape and size of the triangle can, of course, be changed and adapted to the nature of the locality. Three lights are sufficient, but more, arranged in quadrangle, etc., may be used.

Tables can be calculated for each place, according to the size, shape, and position of the lights, by which, on taking the angle of the vessel to the lights, its position and distance may be instantly determined.

The Preservation of the Teeth.

Dr. J. W. Clowes, of this city, is one of our oldest and most esteemed practitioners of dentistry. He is accustomed, on dismissing a patient, after putting the teeth in good order, to present him with a copy of a neatly printed little tract, full of excellent hints, as follows:

DIRECTORY, EXPLANATORY, AND VALEDICTORY.—When the teeth of a patient have been under professional treatment, to the extent of a thorough overhauling or placing in order, he is advised as follows, for his personal observance and benefit.

Saving a set of teeth is one of the most positive and undoubted processes in the world, providing the dentist does his work well and the patient does likewise. This statement is made in all candor, that the patient may comprehend his position; for, if he would retain his teeth, he must "make an effort"—he must, indeed, be a co-worker. When both the dentist and patient are faithful, there can be no result but success. Therefore, O reader! peruse, ponder, and practice these

DIRECTIONS.

In the morning, before breakfast, always brush your teeth—first with water only, then with powder. Powder should be used at least once a day. Without powder teeth cannot be kept clean. Using a brush with tooth soap, just before retiring at night, is a commendable practice. To brush effectually, place the upper and lower rows of teeth parallel to each other, the points of the fronts touching; then use your brush up and down the teeth between the gums, being not unmindful nor fearful to brush as well the gums as the teeth—thereby toughening the one and cleansing the other. Your back teeth need more brushing than your front ones. Wisdom in this respect will be displayed,

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should you show a partial care for the back and outsides of the rearmost teeth, above and below. After each and every meal use a quill toothpick, waxed silk floss, and rinse the mouth with moderately cold water. The intention of these is simply to remove food from among the teeth. Decomposed acidified food, animal or vegetable, is the worst enemy your teeth have now to encounter. The enemy, the combat, and the prize are before you! Will you win or lose?

If I have learned how to place your teeth in their present condition of health, I have learned, also, how you may keep them so—as I, in my operations, have employed appropriate implements, so must you in yours.

These implements are always on hand for those who want them. I do not obtrude them upon any one: I merely state the fact that they are attainable. Employ other means—trust to other implements if you will—but in that case absolve me from all responsibility.

We are about to part. Come and see me at least once a year for inspection. This is important. Should you then exhibit evidences of having performed your part of the saving process, a mutual gladness will be ours—that we have not labored and suffered in vain.

Finally—be earnest. If I have been faithful, skillful, efficient, it is because I have been earnest. Earnest thought—earnest will—earnest action—never fail! They are the synonyms of success.

THE NEOMORPHA.

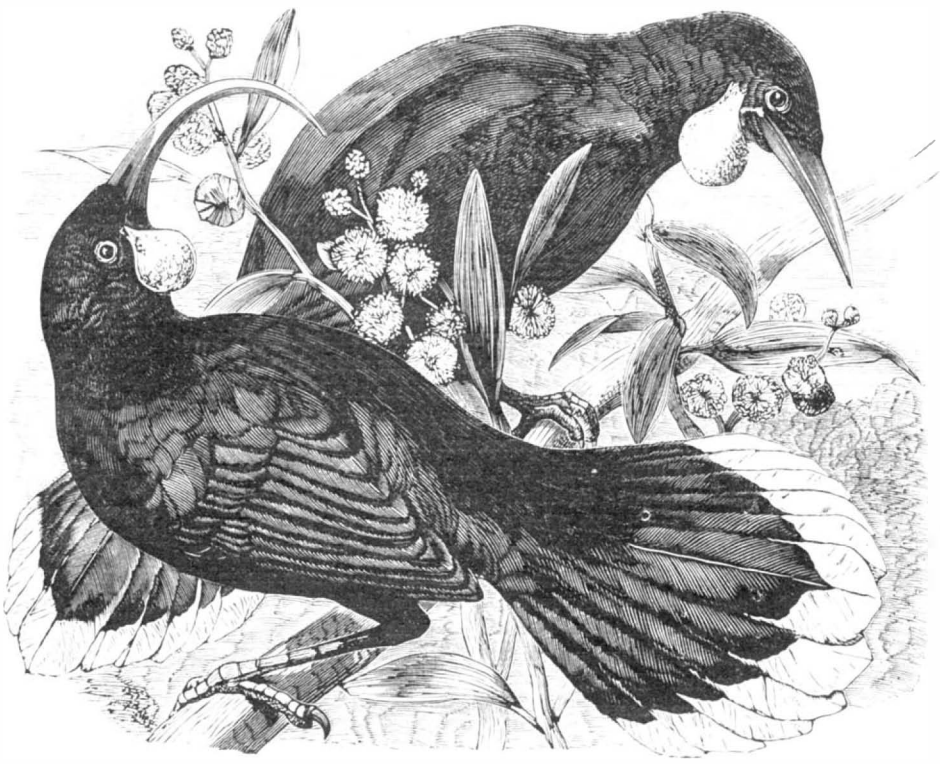
The very remarkable bird which is depicted in the accompanying engraving has been very appropriately named neomorpha, or new-form, as it exhibits a peculiarity of formation which, so far as at present known, is wholly unique.

The locality and habits of the neomorpha are briefly but graphically described by Mr. Gould in the following passage, which is taken from his "Birds of Australia:" "These birds, which the natives call *E Elia*, are confined to the hills in the neighborhood of Port Nicholson, whence the feathers of the tail, which are in great request among the natives, are sent to all parts of the island. The natives regard the bird with the straight and stout beak as the male, and the other as the female. In three specimens which I shot this was the case, and both birds are always together.

"These birds can only be obtained by the help of a native, who calls them with a shrill and long-continued whistle, resembling the sound of the native name of the species. After an extensive journey in search of them, I had the pleasure of seeing four of them alight on the lower branches of the tree near which the native accompanying me stood. Anxious to obtain them, I fired; but they generally come so near that the natives kill them with sticks."

In the coloring of its plumage it is, although rather dark, a really handsome bird when inspected in a good light. The general hue of the feathers is a very dark green, having a bright glossy surface. Upon each side of the neck is a fleshy protuberance or "wattle," analogous to the wattle of the common turkey, and of a rich orange color during life. The tail is of the same deep black-green as the rest of the body, but the uniform monotony of the tint is pleasingly interrupted by a broad band of pure white which is drawn around its edges. The bill is of a rather dark brown color, and is lighter toward the extremity than at the base.

We take our illustration from Wood's "Natural History."



GOULD'S NEOMORPHA.

Natural History Notes.

The Reproduction of Eels.—It has always been a mystery how and where eels are developed, and many fanciful and singular statements have been made regarding the method of reproduction of this very common fish. For instance, not long since we saw it stated that Seth Green believes eels to be merely hybrids between other species of fish, and consequently incapable of reproduction. Doubt on this subject, however, has finally been set at rest by the discovery of eels with eggs—a discovery due to Mr. V W. Edwards, of Wood's Hole. According to the proceedings of the Boston Society of Natural History, recently issued, Mr. F. W. Putnam, at a meeting of the society in January, exhibited one of the eight specimens procured from the market at New Bedford by Mr. Edwards, and by him sent to Professor Alexander Agassiz. The specimens were all of one species, the common fresh and salt water eel (*Anguilla bostoniensis*). In allusion to this subject, Mr. Putnam remarked that all that is known at present is that "this year, for a month past, the eels brought into New Bedford are with eggs in various stages of development. Where they spawn is as yet unknown." The eight specimens examined by Mr. Putnam had ovaries in various stages of development. In two the ovaries were very small, and the eggs exceedingly minute. From these the series showed a gradual increase in the size of the ovaries and the contained eggs. In the specimen exhibited, the eggs were still so small as only to be seen by a lens of considerable power, and not yet ready to be excluded, though the ovaries were large and full. These circumstances seem to point to the fact that, contrary to the usual slow development of eggs in fishes generally, eels rapidly attain their seasonal development; the ovaries, immediately after the eggs are laid, being reduced to a minute size. In the specimen exhibited the ovaries were white, slightly plicated, and of great length, extending from the base of the liver along each side of the intestines to and beyond the anal opening; the left ovary passing for some distance into a cavity of the muscles on the side of the anal fin, while the right ovary does not extend quite so far. When the eggs reach maturity they are dropped into the abdominal cavity, from which they must pass by two very small peritoneal outlets on each side the anal opening and just back of it. These female eels were all silvery on the under side, being the variety known as "silver bellies." It would be interesting to know whether the "golden bellies" variety are the males of the fish.

Habits and Intelligence of the Yellow Hornet.—Mr. Thomas Meehan exhibited, before the Philadelphia Academy of Natural Sciences, young branches of the European ash (*Fraxinus excelsior*), and of the common lilac, which had been stripped of their bark during the summer by the large yellow hornet (*Vespa maculata*). The insects had been carefully watched at the work. They visited these trees in large numbers, and carried the strips of bark away in their mouths. For what purpose they used the bark could not well be ascertained. It is usually supposed that they collect the matter from which their huge nests of paper-like material are made from fences and other dead woody matter. Mr. Meehan thought it remarkable that the insect should collect from plants of the same natural order only, as careful examination of other plants in the vicinity could decide. This hornet, he remarked, was gifted with great intelligence. On one occasion he had observed one with a summer locust, several times its own size, endeavoring to rise with it from the ground and fly away, but failed from the great weight of the locust. It then walked with its prey about thirty feet to a tall maple, which it ascended to the top, and then flew off with its burden in a horizontal direction. There was more than instinct in this act; there was reasoning on certain facts, and judgment accordingly, and the insect's judgment proved correct.

A Living Fish Line.—In the ocean, down among the sea weed stems and pointed rocks, we perceive a long, black, tangled string, like a giant's leather boot lace set to soak. Let us trace it in its various folds and twists, and disentangle some of it; we shall then have in hand a tough, slippery India-rubber-like substance, which might well be pronounced a sea string, and classed with the long trailing weeds among which we have found it. It is a sea string, but not a weed; in fact, a living lasso, capable of consuming the prey it incloses within its treacherous folds. From twenty to thirty feet is no uncommon length for this artful animated fishing line to reach, but its diameter rarely exceeds an eighth of an inch. It has a mouth, however, capable of considerable distention and holding power. Nothing can appear more innocent than this delicate-looking creeper, trailing here and there, as the water wells and flows with the incoming tide. Let an unwary tube dweller, lulled into a false security, stretch forth its tentacles to meet the welcome waves, and a pointed head is adroitly insinuated; the mouth effects a tenacious grasp on the yielding tissues, and the tenant of the tube becomes food for the "long sea worm" (*Nemertes borlassii*), for such is the name of the cord-like freebooter. This strange animal belongs to a group of worms closely allied to the entozoa (parasitic worms), having flat, soft, and often very contractile bodies, but their chief distinguishing characteristic being that they are entirely covered with cilia, by the movements of which they glide over any smooth surface. The length of this extraordinary production of nature is positively prodigious, and its whole history has more the appearance of fable than of sober truth. Charles Kingsley took more than ordinary interest in this creature. He inquires, "Is it alive? It hangs helpless and motionless, a mere velvet string, across the hand. Ask the neighboring annelids, and the fry of the rock fishes; or put it in a vase at home and see. It lies motionless, trailing itself among the gravel. You cannot tell where it begins or ends. It may be a strip of dead sea weed, or even a tarred string. So thinks the little fish, who plays over it and over it, till he touches at last what is too surely a head. In an instant a bell-shaped sucker mouth has fastened to its side; in another instant, from one lip, a concave double proboscis, just like a tapir's, has clasped him like a finger. And now begins the struggle, but in vain. He is being 'played' with such a fishing-rod as the skill of a Wilson or a Stoddart never could invent; a living line, with elasticity beyond that of the most delicate fly-rod, which follows every lunge, shortening and lengthening, slipping and twisting round every piece of gravel and stem of sea weed with a tiring drag, such as no Highland wrist or step could ever bring to bear on salmon or trout. The victim is tired now, and slowly yet dexterously his blind assailant is feeling and shifting along his side till he reaches one end of him; and then the black lips expand, and slowly and surely the curved finger begins packing him end foremost down into the gullet, where he sinks inch by inch, till the swelling which marks his place is lost among the coils, and he is probably macerated into a pulp long before he has reached the opposite extremity. Once safe down, the black murderer contracts again into a knotted heap, and lies like a boa with a stag inside him, motionless and blest."

The Toilet Habits of Ants.—The Rev. H. C. McCook, whose valuable observations on the habits of ants we have before had occasion to record, states that the agricultural ant (*Myrmica*)—and the remark applies to all other ants of which he has knowledge—is one of the neatest of creatures in her personal habits. He has never seen one of his imprisoned harvesters (either *M. barbatus* or *M. crudelis*) in an untidy condition. They issue from their burrows, after the most active digging, even when the earth is damp, without being perceptibly soiled. Such minute particles of dirt as cling to the body are carefully removed. Indeed, the whole body is frequently and thoroughly cleansed, a duty which is almost invariably attended to after eating and after sleep. In this process the ants assist one another; and it is an exceedingly interesting sight which is presented to the observer when this general "washing up" is in progress. They gather in groups upon the earth, cleanse themselves and each other, and sleep. The first operation was observed to be as follows: The ant to whom the friendly office is being administered is leaning over upon one side, as we begin the observation. The cleanser is in the act of lifting the foreleg, which is licked, the mouth passing steadily from the tarsus up to the body; next the neck is licked, then the prothorax, then the head. The attitude of the cleansed all this while is one of intense satisfaction, quite resembling that of a family dog when one is scratching the back of his neck. The insect stretches out her limbs, and, as her friend takes them successively into hand, yields them limp and supple to her manipulation. She rolls gently over upon her side, even quite over upon her back, and, with all her limbs relaxed, presents a perfect picture of muscular surrender and ease. If analogies in nature were not so apt to be misleading, we might venture to suggest that our insect friends are thus in possession of a modified sort of emmetonian Turkish bath. The ants engaged in cleansing their own bodies have various modes of operating. The forelegs are drawn between the mandibles, also through and along the lips, and then passed alternately back of the head, over and down the forehead and face, by a motion which closely resembles that of a cat when cleansing with her paw the corresponding part of the head. The hairs upon the tibia and tarsus seem to serve the purpose of a brush and comb, and Mr. McCook thinks that the object in drawing the leg between the mandibles or through the teeth is to straighten up the hairs, and thus increase their efficiency for service. Moisture from the mouth is evidently used for washing. He has seen one ant kneel before another, thrust forward the head under the face of the other, and lie motionless, expressing quite plainly the desire to be cleansed. The other ant understood this, and went to work. The amount of time devoted to these toilet duties is very great with im-

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prisoned ants, but is probably not so great in a state of nature. Mr. McCook suggests that with ants, as with men, an artificial condition of society gives inducement to a larger devotion to personal appearance.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, September 28, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	4 27 mo.	Saturn in meridian	11 29 eve.
Venus rises	4 29 mo.	Uranus rises	3 08 mo.
Mars rises	5 40 mo.	Neptune rises	7 13 eve.
Jupiter sets	0 15 mo.	Neptune in meridian	2 02 mo.

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	11 31 eve.	Procyon rises	0 46 mo.
Mira (var.) rises	7 54 eve.	Regulus rises	2 50 mo.
Algol (var.) in meridian	2 32 mo.	Spica	invisible.
7 stars (Pleiades) rise	7 41 eve.	Arcturus sets	8 51 eve.
Aldebaran rises	9 00 eve.	Antares sets	8 11 eve.
Capella rises	6 27 eve.	Vega in meridian	6 02 eve.
Rigel rises	11 06 eve.	Altair in meridian	7 14 eve.
Betelgeuse rises	10 52 eve.	Deneb in meridian	8 07 eve.
Sirius rises	1 11 mo.	Fomalhaut in meridian	10 26 eve.

REMARKS.

Mercury rises 1h. 26m. before the Sun, and 6m. after the beginning of twilight. He is advancing among the small stars of the constellation *Leo*, being two thirds through the sign. There are no stars in his vicinity bright enough to be mistaken for him; the brightest being *β Virginis*, of the third magnitude. He will be in conjunction with Venus September 30. Their conjunction in right ascension occurs about 9 o'clock in the morning, and as Mercury has the greater apparent eastward motion in right ascension, he will, when first seen, be east of Venus. Venus will be the brighter and south of Mercury about ¼°. Mars is still too near the Sun to be seen. Jupiter will be near the moon October 4. Saturn is a trifle east of the equinoctial colure, and a line from Alpheratz through Algenib (the two eastern stars in the square of *Pegasus*) produced 30° southward will pass through him.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. The times given are merely approximations, but are sufficiently accurate for ordinary observers.

M. M.

Position of Planets for October, 1878.

Mercury.

On October 1 Mercury rises at 4h. 36m. A.M., and sets at 5h. 10m. P.M. It may be perhaps seen before sunrise. On October 31 Mercury rises at 6h. 59m. A.M., and sets at 5h. 2m. P.M.

Its path is so nearly that of the sun that it cannot be seen. Mercury, which is near Venus early in the month, passes south of it before the middle of the month.

Venus.

On October 1 Venus rises at 4h. 36m. A.M., and sets at 5h. 8m. P.M. It will be seen that at this time Mercury and Venus rise and set nearly together. On October 31 Venus rises at 5h. 49m. A.M., and sets at 4h. 35m. P.M.

Mars.

Mars is not likely to be noticed by the casual observer. It rises on October 1 at 5h. 38m. A.M., and sets at 5h. 32m. P.M., being a little south of the equator. On the 31st Mars rises at 5h. 20m. A.M., and sets at 4h. 18m. P.M.

Jupiter.

Although Jupiter has passed its best position, it is very conspicuous in the evening.

On October 1 Jupiter rises at 2h. 38m. P.M., comes to meridian at 7h. 16m. P.M., and sets at 11h. 54m. P.M. On October 31 Jupiter rises at 47m. after noon, and sets at 10h. 8m. P.M.

Jupiter is always interesting; the changes of position of the four moons give great variety to the views which can be obtained with a small glass.

If we take the hours between 8 and 10 P.M. for our observations, we shall find fourteen evenings in October when some one of the four satellites is invisible, and one evening when two are invisible.

The 1st satellite is lost to sight during a part of these hours on the 1st, 8th, 17th and 24th of October, by going behind the planet. The same satellite is unseen at these hours on the 9th and 16th, because it is in front of the planet and its light is lost in that of the planet.

On October 4 the 2d and 4th satellites are missing at the same time, both being behind the planet. The 4th (that which is furthest from the planet) goes behind the planet early in the evening; the 2d, which is the smallest of the moons, disappears later; from 9 to 10 P.M. Jupiter is seen with two moons only.

October 13 the 2d satellite is not seen until after 9 P.M., as its light is lost in that of Jupiter, and on October 20 the same moon is again invisible because it is between us and the planet in transit. On October 22 this satellite may be seen to reappear from an eclipse, it having passed through the shadow of Jupiter.

The 3d satellite, which is the largest, is not seen on October 5 until it has passed off from the planet's face. On October 12, at about 9 P.M., this large satellite disappears (to small telescopes) by coming between the planet and our view; on October 23 it cannot be seen early in the evening, but comes out of the planet's shadow; and on October 30 it is not seen because it is behind the planet. Jupiter will be very near the moon October 31.

Saturn.

Saturn is in excellent position for evening observers. October 1 Saturn rises at 5h. 27m. P.M., and sets at 5h. 6m. A.M. of the next day. October 31 Saturn rises at 3h. 24m. P.M., and sets at 2h. 59m. on the next morning.

Saturn comes to the meridian at 11h. 16m. on October 1, at a height, in this latitude) of 45°. It can readily be known by its steady white light.

The ring which surrounds Saturn is seen now nearly on edge, so that to a small telescope it will seem like a line of light projecting on each side of the planet's disk. An ordinary telescope of perhaps two or three inches aperture will show the largest satellite, Titan.

Uranus.

Uranus will not be seen during October unless it be with a glass and in the early morning hours. Uranus rises on October 1 at 2h. 56m. A.M., and on the 31st at 1h. 5m. A.M.

Neptune.

Neptune rises on October 1 at 6h. 59m. P.M., and on the 31st at 5h. P.M. It will come to the meridian October 27th nearly at midnight, and its position is good, but to see it requires the best telescopes.

The Pigments of the Retina.

Some time ago we referred to the highly interesting experiments of Dr. Kühne, of Heidelberg, in connection with "visual purple"—that pigment of the retina which has been proved to be so susceptible to the influence of light. Following up his investigations, Dr. Kühne has published several important papers on the subject, the last of which appears in the current number of the *Journal of Physiology*. In the article under consideration, the author takes up the other retinal pigments, which are either not at all or only slightly affected by exposure to light.

In one of his previous papers he gives the method of preparation, the properties, and spectroscopic appearances of three distinct pigments of great stability, which he had discovered, and succeeded in isolating from the retina of a bird. In the same paper he simply mentions the black pigment of the retina, which he believes to be exceedingly stable, and but slightly alterable by light; but, while the paper was still in press, he discovered that this black pigment does not resist the action of light so perfectly as he was at first led to suppose, and is, after all, slowly altered by exposure; he therefore remarks that "if we consider the extremely widespread occurrence in the animal kingdom of the black pigment of the eye, and other similarly stable pigments, it is scarcely possible to repress the idea that these, in addition to visual purple, also represent visual excitants, or so-called visual substances, and are intended to be decomposed by light during life, and to yield those substances which stimulate chemically the terminal apparatus of the visual organ." He likewise directs attention to the remarkable fact that the retinal pigments of a bird he has discovered are so mixed with oil globules that the colors in the cones of the retina represent exactly half the colors of the spectrum, viz., from red to yellowish green, so that with their complementary colors they yield all the colors of the spectrum. He has observed, further, that these three pigments are most readily decomposed by blue light, less by green, and not at all by red.

The importance of these various discoveries of the able German histologist, in reference to vision, can scarcely be overestimated.

Insect Powder.

Why the flowers of the composite plants *Pyrethrum carneum* and *P. roseum*, when pulverized to form the well-known "Persian Insect Powder," should prove so destructive to insects, while perfectly innocuous to other forms of animal life, has not hitherto been understood. Rother, who has investigated the chemical composition of *P. roseum*, ascribes its active powers to the presence of an acid, or, more properly, of a glycoside, which he terms Persicin. It is a brown non-crystallizable substance, having the odor of honey, and when boiled with hydrochloric acid is converted into sugar and Persiretin. With alkalies it forms a neutral amorphous salt, as well as an acid crystallizable one.

Persiretin also behaves like an acid. The plant contains, in addition, an oily resin-like acid, Persicein. No alkaloid was found by Rother; Bellesone, however, obtained from the plant a crystallizable substance which exhibited exceedingly acetic properties. Hager, who has examined the flowers of both *P. carneum* and *P. roseum*, attributes their insecticide effects to the presence of two substances, one of which, a body allied to trimethylamine, is combined with an acid in the flower. This powder as well as the pollen has a peculiarly powerful effect as an irritant. Hager finds that aqueous or alcoholic extracts of the powdered flowers contain little of these ingredients, and consequently to be of no value as insecticides.

What Makes Success,

In business life two things are essential to success: First, sound judgment; second, activity. In all departments we find a greater deficiency in judgment than in other requisites. Long familiarity in a given department does not necessarily produce it, though this will undoubtedly aid and strengthen it. Only by reliance on one s self, and feeling individually responsible for the results of action founded on one's own efforts, can the fact be established of good or bad judgment. Special talent will not furnish it for a man who may have capacity for acquiring information, may be able to enter into learned discussions on supply or demand, may have vast knowledge of productions, their sources of supply, and their various uses, and still lack the ability to apply to practical and everyday use the benefits of such information.

So also one may become familiar with all the details of business through long experience in the service of others, and as a servant, or in an executive capacity, making himself invaluable without ever realizing the responsibility attached to individual discretion or judgment. In this belief we find an answer to the oft-repeated inquiry why so large a portion of business men are unsuccessful; to claim that so many fail to meet fair success through force of adverse circumstances, instead of permitting circumstances to control them. Men who have the capacity to comprehend the whole question presented to them, to properly weigh not only the side of success but of failure, and who understand the importance of right thinking and the full penalty of mistake, are the ones who succeed, and whether they get credit for having good judgment or not, they certainly exercise it.

Roses in Pots.

The ever-blooming roses are best for house culture in pots—because they bloom quicker and more continuously than any of the others, and besides this, their style and habit of growth are more bushy and better adapted to the purpose. They can be kept nicely with other growing plants, and with proper attention to their requirements will bloom freely. (1.) Do not use too large pots—if possible, not more than three or four inches. The rule is, one size larger than the plants have been grown in. The smaller the pot—provided, of course, it is large enough to contain the plant—the quicker and stronger the plant will start. It is very difficult to get a small plant to live and grow in a large pot. A rose will not bloom much till the pot is well filled with roots; therefore, small pots facilitate quick bloom. If the pots are old, they should first be thoroughly washed. If new, they should be soaked in water, otherwise they will absorb the moisture from the plant. (2.) Have good rich soil—mellow and friable. That made from old decomposed sods is best. If manure is used, it should be old and thoroughly composted; fresh manure is injurious. (3.) Put some bits of broken crockery, charcoal, or other similar material, in the bottom of each pot to facilitate drainage, then enough fine earth to raise the plant to a proper height. It should not be much deeper than it was before. Next put in the plant and spread out its roots as near their natural position as possible; then fill in fine earth and press firmly down with the hand. When done, the pot should not be quite full; a little space is needed for water. (4.) When first potted, water thoroughly, and if the sun is strong, shade for a few days; then give full light and air. Though the plant should not be allowed to wither for want of water, the earth should get moderately dry before watering again. Too much water is worse than not enough. Very little water is needed until the plant starts to grow.—*Guide to Rose Culture.*

Dyspepsia.

This malady, which is prevalent in all countries and especially so in the United States, has been ably treated, from a physiological standpoint, by Dr. J. Cornillon, of Vichy Springs, France. His lengthy paper on the relations of dyspepsia with constitutional diseases may be found in the SCIENTIFIC AMERICAN SUPPLEMENT of July 15 and 22, and will be read with interest and profit by all dyspeptic sufferers. Send 20 cents to this office for the two numbers, 132, 133.

New Agricultural Inventions.

Mr. George E. Clow, of Seymour, Ind., has patented an improved Scythe Snath Fastening, which consists of a ferrule formed with solid neck extension and enlarged head, slotted to receive and adjust the clamping loop. This device admits of a quick adjustment of the scythe on the snath.

Mr. John C. Welsh, of Stokes Station, Ill., has patented an improved Sulky Plow which possesses several novel features that cannot be properly described without an engraving.

The Deepest Mines in Nevada.

The Yellow Jacket is now the deepest mine on the Comstock lode, the greatest depth attained in it being on the 2,400 level, which is 2,833 feet below the Gould and Curry croppings, the datum line for the Comstock mines. The next deepest mine on the lode is the Savage, in which the greatest depth attained is 2,430 feet from the surface, or 2,643 below the datum line. The 2,200 level of the Yellow Jacket is equal to the 5,400 level of the Imperial; the latter is the third deepest mine on the lode.

ONE hundred and eleven thousand nine hundred and fifty-five persons visited the Paris Exhibition on the 15th of August, one of the chief holidays of the year.

AT a great shoe manufactory in Lynn, Mass., recently, a pair of kid side-laced woman's boots was made from the stock in just eleven minutes, in sight of visitors.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

For Power&Economy,Alcott's Turbine,Mt.Holly,N.J.

Wanted.—Manufs. to make new Toy Gun and Target, mostly of wood. Address W.D.Skidmore,340 E.120St.,NY.

Latest and best Books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

"The Plumber and Sanitary Engineer" contains popular, practical, and scientific articles on drainage, water supply, heating, and gas lighting. 15 cents a copy. $1.50 per year. P. O. Box 3037, New York.

New York Safety 4 H. P. Engine and Boiler for sale cheap for cash. Lovegrove & Co., Philadelphia, Pa.

James T. Pratt & Co., 53 Fulton St., N. Y. Scroll Saws and Designs. Send for circular.

Exhibition Magic Lantern and 60 Views, only $25. Catalogue free. Outfits wanted. Theo. J. Harback, Importer and Manufacturer, 809 Filbert St., Phila., Pa.

A Civil Engineer, a graduate of the Rensselaer Institute, wants employment, and an opportunity to perfect himself in the designing of machinery. He understands mechanical draughting, heat and strain calculations, and has had practice in a shop and in the management of marine engines, and knows French and German thoroughly. Address H. L. B., 40 West 19th St., New York.

Safety Linen Hose and Rubber Hose for all purposes at the best rates. Greene, Tweed & Co., 18 Park Pl., N. Y.

Babbitt Metal. Four plain receipts for making best grades of Babbitt Metal. Send one dollar. Address James Swan, Larned, Pawnee Co., Kansas.

The improved Gatling Guns fire over 1,000 shots per minute, and are the most destructive war weapons ever invented. Gatling Gun Co., Hartford, Conn., U.S.A.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Blowers.—One No. 5, two No. 6, regular pattern, steel, pressure Sturtevants; one No. 6, Hot Blast Apparatus; also other sizes for sale very low. Exeter Machine Works, 140 Congress St., Boston, Mass.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Use the Patent Improved Sheet Iron Roofing and Drip Crimped Siding made by A. Northrup & Co., Pittsburg, Pa. Send for circular and prices.

Engine Builders' Brass Goods, Oil Feeders, Glass Oil Cups, Shaft Cups. All goods strictly first class. Address Cincinnati Brass Works.

Nickel Plating.—A white deposit guaranteed by using our material. Condit,Hanson & Van Winkle,Newark,N.J. English Agency, 18 Caroline St., Birmingham,

Write to E. & F. Gleason, 56 Canal street, Philadelphia, for standard wood tools,

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

North's Lathe Dog. 347 N. 4th St., Philadelphia, Pa.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Alcott's Turbine received the Centennial Medal.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

Howard Patent Safety Elevators. Howard Iron Works, Buffalo, N. Y.

Expectant Advertisers will serve their interests by consulting C. K. Hammitt's Advertising Agency, 206 Broadway, N. Y.

Emery, Glue, Vienna Lime, and all polishing goods. Greene, Tweed & Co., 18 Park Place, N. Y.

Kreider, Campbell & Co., 1030 Germantown Ave., Phila., Pa., contractors for mills for all kinds of grinding.

The only Engine in the market attached to boiler having cold bearings. F.F.& A.B.Landis, Lancaster, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

Any of our readers in the smaller towns who are seeking employment, or who wish to add to their income, would do well to correspond with the H.W.Johns Manufacturing Co., 87 Maiden Lane, N. Y. This company are the most extensive manufacturers in this country of strictly first-class Liquid Paints for dwellings and general structural purposes, and they offer liberal inducements to reliable men as local salesmen for their Asbestos Paints, Roofing, etc.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

NEW BOOKS AND PUBLICATIONS.

REPORT OF THE NEW JERSEY STATE COMMISSION FOR THE ENCOURAGEMENT OF MANUFACTURES OF ORNAMENTAL AND TEXTILE FABRICS. 1878. Trenton. 8vo., paper, pp. 90.

The greater portion of this pamphlet is devoted to a review of efforts made at home and abroad to secure the industrial and artistic education of the artisan class, the Commission believing that by such means the object aimed at can best be attained. A bureau of statistics like that of Massachusetts may be made very helpful in carrying out the work.

GENERAL INDEX TO APPLETON'S AMERICAN CYCLOPEDIA. 1 vol. 8vo. pp. 810. New York: D. Appleton & Co.

This volume is intended to make readily accessible the information given in Appleton's Cyclopedia, and must prove a great time saver to such as have frequent occasion to consult that work. It adds to the value of the general volumes as markedly as an elaborate index does to a book having a good table of contents; and at the same time it provides a handy volume for reference with regard to the spelling and pronunciation of names (English, foreign, and scientific), technical terms, and so on. Frequently an explanatory word or phrase is inserted in the index in such a manner as to obviate the need of consulting the general volumes at all. To some extent also it may be helpful in the search for information in other cyclopedias and special treatises.

Notes & Queries

(1) M. B. writes: Could you inform me if there are any set rules for the signals between the pilot and engineer on a steamboat, and give the signals the pilot uses in signaling boats? A. The ordinary code of engine signals is as follows: Engine stopped, 1 stroke on gong, go ahead slow; engine stopped, 2 strokes on gong, back slowly. Engine going ahead or back slowly, jingle bell, go fast; engine going ahead or back slowly, 1 stroke on gong, stop; engine going ahead or back fast, 1 stroke on gong, slow engine. The pilot signals are: Steamers approaching head on—Each steamer must pass to the right of the other, and the pilot who first determines to turn gives one short blast of the steam whistle, which must be immediately answered by the other pilot. Two short blasts, answered by other pilot, when first pilot considers it safer to pass to the left. Series of short blasts, in rapid succession, signifies that the pilot who makes them is in doubt as to the signals of the other pilot, and wishes to have them repeated. One long blast to be given within a half mile of a curve or bend, to be answered by the pilot of any other steamer within hearing. One long blast in a fog signifies that the steamer is under way. Three blasts in a fog signifies that the steamer is drifting or at anchor.

(2) W. W. S. writes: We have a 3 x 4 inch vertical yacht engine, with variable (link) cut-off, and we wish to get all the power we possibly can from it. 1. What kind, size, and pressure of boiler shall I require? A. Make a boiler 28 inches in diameter and 45 inches high, for 130 lbs. of steam. 2. What is the most power I can get from it? It is built strong. A. Probably about 5 horse power.

(3) E. J. P. writes: I have stated to a friend that the moon can never be absolutely full, which he denies. I base my assertion on the fact that if the moon were to be absolutely full it would pass into the earth's shadow and hence be eclipsed. Who is right? A. You are right.

(4) G. S. McG. asks if there is a formula given to calculate the height that water can be raised by suction at different elevations above the level of the sea, say from 8 to 10,000 feet. A. Multiply the height of the barometer in inches (reduced to a temperature of 32° Fah.) by 1·133. The result is the height, in feet, of a column of water that will balance the atmospheric pressure.

(5) P. C. asks for a recipe for harness blacking. The principal requirements are that it should make the leather flexible, waterproof, give a good smooth black finish so that dust will not adhere, easy of application, quick drying, not injurious to the texture. A. The following composition is said to give excellent results: Orange shellac, 1 lb.; alcohol (48 per cent) or wood naphtha, 1 gallon; dissolve; asphaltum (genuine), 1 lb.; neat's foot oil (hot), 4 fluid ozs.; soften the asphaltum with the oil and mix it with the lac solution; then add fine ivory black, q. s., and bitter almond oil, 1 oz. Agitate until uniform mixture is effected, and bottle.

(6) C. G. asks: Does the generating of steam rapidly cause any extra strain on boilers when not allowed to go beyond a certain pressure, say 60 lbs.? A. Ordinarily, when a boiler is forced, it deteriorates more rapidly than when the combustion is slow.

(7) M. J. C. writes: I piped a stationary engine the other day, and ran the exhaust pipe 25 feet horizontal and 25 feet perpendicular: would the engine run better if I run my pipe down through the floor? A. If the exhaust pipe is sufficiently large, there would not be much advantage in the change. Data insufficient in first query.

(8) K. F. asks: Can the sound from a number of voices or instruments of any kind be heard at a greater distance than the sound from one voice or instrument, and what is the ratio of distance as compared with the combined number of sounds? A. Yes. "The intensity of sound is inversely as the square of the distance of the sonorous body from the ear," consequently the sound produced by four voices or instruments can be heard twice as far as the sound produced by one voice or instrument.

In making a phonograph from drawings in SCIENTIFIC AMERICAN SUPPLEMENT, are we not liable for infringement of Edison's patent? A. See editorial "Rights of Investigators," in No. 9 of current volume of SCIENTIFIC AMERICAN.

(9) C. N. O. asks: Which will support the greater weight, a 12 foot 8 inch diameter solid column, or a 12 foot 8 inch diameter ¾ inch metal hollow column? A. The former.

If a machine were made to use any natural force, as gravity, continuously, would it be perpetual motion, as that term is generally used? A. Yes.

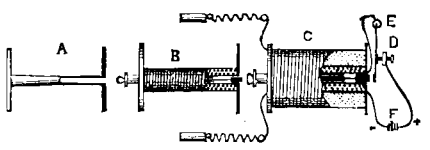
(10) W. H. B. asks for a method of preparing paper blue for clothes. A. Mix dry Prussian blue with about 60 per cent of hot water and 15 per cent of potassium ferrocyanide (yellow prussiate) in powder; pass the mixture through a fine sieve, dilute it with a little hot water, and pass the dry unsized paper through the solution, and expose it to warm air until dry.

(11) G. A. R. asks: What is the best and cheapest substance to enamel bricks, and the mode appertaining? A. Ordinary red tiles may be enameled or glazed by subjecting them, while well heated, to the action of the vapor of common salt fused in the furnace.

(12) J. W. S. asks for a good black dye for restoring color on hats without boiling them in it, and also what makes a good dye for dyeing black by boiling? A. 1. Water, 100 parts; logwood, 40; sulphuric acid, 0·5; boil and add ferrous sulphate, 3 parts, copper sulphate, 1. 2. For 100 parts of goods, camwood, 8 parts, boil 30 minutes, and add potassium bichromate, 3 parts; alum, 1; argol, 1; boil for 30 minutes, then let off, and allow the goods to stand over night. Then boil for an hour in logwood, 45 parts; fustic, 8; sumac, 4.

(13) R. B. writes: 1. We have a telephone circuit of about a mile; there are no telegraph wires near it, and of late the clicking sound has become so great that at times the person speaking cannot be heard. Will you please inform me of the cause of the clicking sound? A. It is probably due to earth currents. 2. Is there a remedy for it, and if so, what is it? A. Use a return wire, or put a small resistance coil at each end of the line.

(14) F. F. C., W. A., and others: An ordinary induction coil may be made in the following manner: Turn a spool, A, of wood or hard rubber, 4 inches long with flanges, about 2½ inches in diameter. The spool should be ¾ inch internal diameter and quite thin. Upon this spool wind two layers of No. 16 insulated copper wire, as shown at B. Place around the coil thus formed two or three thicknesses of paper which has been soaked in melted paraffin. Upon the paraffin paper wind from 300 to 400 feet of No. 40 silk covered copper wire, placing under each layer a thickness of paraffin paper. The ends of the wire of the inner or primary coil extend outward through the flange of the spool, and one of them is connected with a post, E, to which is attached a current breaking spring, supporting an armature in front of a short soft iron plug in the end of the spool. The current breaking spring has



attached to it a small disk of platinum, which rests against the adjusting screw in the post, D. This post is connected with the battery, F, and the latter communicates with the terminal of the primary coil. The ends of the wires of the outer or secondary coil extend through the flange of the spool and are connected with binding posts. It will be noticed that the outer coil has no connection whatever with the inner one. The secondary current is induced by the current in the primary coil. To regulate the strength of the secondary current a bundle of soft iron wires is inserted into the spool and moved out as occasion may require.

(15) C. B. writes: My brownstone front stoop is covered with a green mouldy substance that looks bad. Please give me a recipe for removing it and not injuring the stone. I notice a great deal of it in all cities, only on the south side of the street. A. Try a little strong aqueous solution of caustic soda. It should remain ten minutes in contact with the stone, which, after washing with water, should be well rubbed with a stiff brush or broom.

(16) D. W. A. writes: I want a cheap and simple method of manufacturing gas for an experimental air carriage, not out of coal. Also the size of a cigar shaped balloon large enough to raise about 300 lbs. A. Where coal gas is not obtainable the gas (hydrogen) is prepared by decomposing dilute sulphuric acid (oil of vitriol 1 part, water 3 parts) with scrap iron in capacious wooden vessels or casks. For the amount of materials required, etc., see p. 107 (22) and (8), current volume, SCIENTIFIC AMERICAN, also p. 64, vol. 32.

1. What do you mean, when you say, in speaking of a screw for propelling boats, that it has a pitch of 16 inches? Do you mean that the screw is of such an angle that if continued around the shaft it would make one revolution around it in that distance? A. Yes. 2. And for a small screw, say of 10 or 12 inches diameter for small canoe, what pitch should it have and how many blades? And should the blades be curved or straight? A. A true screw with three blades, pitch 1½ times the diameter, will do very well.

(17) H. B. asks what size a boiler and engine should be for marine use (size of engine 2 inches in diameter and 3 inches stroke), double engines. I want the engines for a row boat, with speed from 6 to 8 miles per hour. A. Make a tubular boiler, 24 to 28 inches in diameter, 4 feet high.

(18) A. E. R. writes: 1. I am running a Corliss engine, made about the year 1863. The cylinder is 14 inches x 3½ feet, 50 revolutions a minute, and 60 lbs. steam. In setting the valves I gave the cut-off valves ⅛ lead, and the exhaust valves ¾. I do not think the boiler safe above 60 lbs., and the engine has to work rather hard to do the work required of it. Am I getting the best results with the valves set as stated? A. We think these are good proportions; but the only way of telling certainly whether the valves are set to the best advantage would be by an indicator diagram. 2. How can I test sperm oil to tell if it be pure, and is it considered the best oil for cylinders? A. We do not know of any very simple tests except that of use. Some of the natural oils are much used for cylinder lubrication.

(19) S. K. asks if the United States Steam Boiler Explosion Commission will experiment again this year. A. We believe the Commission has adjourned *sine die*.

(20) D. S. E. asks: Is it at all possible for a steam boiler to burn out if it is kept free from scale and has the proper care in keeping it clean? Even with a forced fire or a blast, can the boiler receive any injury when the above care is taken? A. If the boiler is so designed that there is not a free circulation, it can be burned, when perfectly cleaned, by a powerful blast.

(21) C. E. G. asks: I wish to raise the greatest amount of water possible, using a 5 or 10 horse power engine. Please give the best machine for that purpose. A. We think a good rotary pump will give the most satisfactory results.

(22) G. W. writes: As we contemplate building a steamboat we have clubbed (six of us) together, and we come to you for advice. We should like to build a boat to carry about 20 persons. Can you give us an idea how to have it built, such as length, width, size of boiler, engine, and screw, and about the cost? A. We take the following from the price list of a well known builder of steam yachts: Hull, 38 feet over all, 7½ feet beam, 3½ feet draught. Engine, 5½ x 7 inches. Propeller, 3 feet diameter, 4 feet pitch. Boiler 3 feet diameter, 4¾ feet high, 170 square feet of heating surface. Price $2,300.

(23) J. J. N. asks if vertical retorts for the distillation of coal are much in use. A. Such retorts are rarely employed in this country.

(24) H. H. C. writes: In a back number you stated that if a person wanted to become a locomotive engineer, shop experience would be requisite, therefore I ask: 1. Would it make any difference whether I worked in the machine shop of a foundry or car shop? A. A locomotive manufactory would be the best. 2. Is there any work published on "Locomotive Engineering?" If there is, please state the title and author. A. Forney's "Catechism of the Locomotive" is a useful work. 3. What is the average pay for locomotive engineers on our Western railroads? A. From $2.50 to $3 a day will probably represent a fair average. 4. After having shop experience, how should I proceed to become an engineer? A. Try and procure a situation as fireman on a locomotive.

How many miles of railroad does Australia possess? A. In 1876 there were in Australia 1,680·5 miles of railroad in operation, and 1,376 miles in course of construction.

(25) G. W. M. asks: Can I obtain a liquid of greater specific gravity than sulphuric acid? A.

(Specific gravity at 32° Fah.)

Mercury	13·59
Bromine	3·18
Phosphorus terbromide	2·92
Silicon bromide	2·81
Stannum (tin) perchloride	2·26
Arsenic terchloride	2·20
Methyl iodide	2·19
Sulphuric acid	1·85

(26) J. S. Q. writes: I have a tugboat, 60 feet long, 14 feet wide, scow bow and stern. She runs 7½ miles per hour up stream, and makes all the steam I want to carry, 120 lbs., with lump coal. I wish to use slack instead of lump coal, and will ask your advice in making alterations for burning slack. The engine is 10 inch, 12 inches stroke; boiler is firebox make, 11½ feet long; boiler shell is 8 feet long, 36 inches in diameter, has 43 flues 2½ inches in diameter, 8 feet long; firebox is 3 by 3 feet, the grate bars have ½ inch opening. She exhausts in the chimney; the exhaust pipe nozzle is 12 inches above top of flues, and is cramped from 2½ to 1¼ inches. The smoke box door at the after end of boiler is not tight, leaks great deal of air; the flues are coated with a heavy scale, and still she makes plenty of steam with lump coal. I propose to remove all the scales, which I can do, and keep the flues clean, and reduce the opening in the grate bars to ⅛ inch, and cut the nozzle off even with the top of the flues, and leave the opening 2½ inches, and make the smoke box door at the after end of the boiler air tight, and then I think I can make 120 lbs. of steam with slack. My chimney is 12 inches wide. A. We think it quite probable that your plan will be successful. You may have to increase the draught by a steam jet.

(27) W. McC. writes: Having had some doors to varnish, I was asked if I could leave them so that the panels would be glossy and the stiles dead or flat. Now I would like to have you tell me if there is anything that will kill the gloss on varnish and still not injure it. A. You might rub them down with fine pulverized pumicestone and leave the surface without polish.

(28) D. W. B. writes: 1. The switching engine No. 60 of the N. Y. & N. H. & H. R. R., after the steam has been shut off, and while fetching, makes a heavy thumping noise, apparently in the cylinders. The engineer does not know how to account for it. What is the cause? A. From your account we judge that it may be due to water in the cylinder, or contraction of some of the steam connections, but the data are scarcely sufficient to enable us to form a very intelligent opinion. 2. How is the air exhausted for the vacuum brake? A. By a steam ejector. 3. How can I compute the horse power of a locomotive? A. Multiply the mean pressure on the piston in pounds, by the piston speed in feet per minute, and divide the product by 33,000.

(29) C. F. B. asks: Can any reader of the SCIENTIFIC AMERICAN give me a rule to measure rubber belting in the roll? A. The following rule is given in Cooper's work on belting: D = diameter of outer coil in inches. d = diameter of inner coil in inches. n = number of coils. Length in feet equals $0{\cdot}1309\ n \times (D+d)$.

(30) W. H. A. asks for a formula for preserving insects. A. Labouliere recommends for the preservation of insects in a fresh state, plunging them into a preservative fluid consisting of alcohol with an

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excess of arsenious acid in fragments; 1½ pint will take up about 14 troy grains of arsenic. The living insect put into this preparation absorbs about $\frac{3}{1000}$ths of its own weight. When soaked in this liquor and dried it will be safe from the ravages of moths, anthrenus or dermestes. This liquid will not change the color of blue, green or red beetles if dried after soaking 24 hours. Hemiptera and orthoptera can be treated in the same way. The nests, cocoons, and chrysalids of insects may be preserved by means of this solution, or by dipping into benzine or a solution of phenol or creosote.

(31) C. E. T. writes: Will you inform an "old subscriber" if any definite experiments on the conductivity of dry steam are on record? Will the amount of heat required to raise the temperature of a pound of water 1° per minute increase the temperature of dry steam with the same rapidity? If a copper globe capable of containing one ounce of water converted into steam at 100 lbs. pressure per square inch be subjected to the same heat which raised the temperature of the water 1° per second, will the steam conduct or convey the heat throughout its bulk so as to increase at the same rate? A. According to Regnault's experiments, the amount of heat that raises the temperature of a pound of water 1° will raise the temperature of 3·28 lbs. of saturated steam, or 2·08 lbs. of superheated steam, through the same range.

(32) P. R. asks if there is any simple way of testing silver to see if it is alloyed with copper. A. Cover a small fragment of the alloy with 3 parts of pure warm nitric acid; when it has dissolved add an equal volume of strong ammonia water—a blue tint indicates copper. Or add pure hydrochloric acid instead of ammonia, and bring a drop of the filtered solution in contact with a drop of solution of potassium ferrocyanide on a clean porcelain surface—a reddish brown coloration indicates copper.

(33) E. J. W. asks: How can I make indelible inks of different colors, black, purple, red, etc., to mark linen, etc., with stencil plates, rubber stamps, etc. What is the best manner of heating the vulcanized rubber and plaster form in making rubber hand stamps? A. See recipes on pp. 11 (35), 250 (2) (4), 257 (60), 75 (9), 96, 236 (37), 43 (2), and 107 (37), vol. 38, and 284 (54), 300 (46), and 246, vol. 37, and 11 (7), 59 (3), 117, 251 (52), 331 (9), and 284 (38), vol. 36, SCIENTIFIC AMERICAN. Also p. 1226 SCIENTIFIC AMERICAN SUPPLEMENT.

(34) O. S. asks how to detect the mineral substance terra alba in commercial cream of tartar. A. Digest the salt with 4 or 5 times its weight of strong ammonia water, for a short time, warm and filter the solution, and wash the residue with warm water—the insoluble residue contains all the earthy impurities.

(35) H. W., Jr., asks how to construct a storm glass as used by the United States Naval Department. A. You perhaps refer to the instrument described on p. 38, vol. 36, of the SCIENTIFIC AMERICAN. Dissolve 2 parts of Borneo camphor, 1 part of potassium nitrate (saltpeter), and 1 part of ammonium chloride (sal ammoniac) in 100 parts of 95 per cent alcohol, and add enough distilled water to precipitate a small portion of the camphor. Place this in a large test tube with the upper end drawn out so as to leave an opening not larger than a pinhole. The instrument, which is not of much practical value, is fixed in the open air out of direct sunlight.

(36) C. W. P. asks: What metal in band shape, say ¾ inch wide by $\frac{1}{32}$ inch thick, will stand running over a 5 or 6 inch pulley two or three thousand times, the band to touch only one fourth of the face of pulley? Have tried common band iron, but find it quickly crystallizes and breaks. A. We think you can use steel of a quality similar to that employed for band saws.

(37) T. G. McC. asks: 1. Would I have to pay a license, or would I be infringing, on any of the rubber patents if I manufactured some small inventions of my own out of rubber, not vulcanized but soft rubber? A. We think the soft rubber patent has expired. 2. Where can I get rubber goods manufactured, providing I invented something that required a rubber attachment? A. Any of the rubber manufacturers in this city would probably make your articles. Your 3d and 4th questions are indefinite.

1. Is there a patent on the process of lining metal pots, etc., with what is called porcelain lining? A. The processes in use are covered by several patents. 2. How is it done? A. The materials are reduced to a uniformly fine powder and made into a paste with water. This is applied to the vessels, dried, and subjected in a muffle or kiln to a temperature sufficiently high to fuse the enamel. 3. Could tinware be so lined? A. Tinned iron may be thus enameled, but the coating of tin becomes oxidized in the process. 4. If so, where could I get it done? A. Lalance & Grosjean, Beekman and Cliff streets, New York.

(38) C. B. asks whether it is possible to compress the air for the use of an engine by means of a windmill. If so, it will supply a great want on the farm. Every farmer needs a light power to saw wood, grind corn, make cider, and many other purposes. An ordinary windmill does not furnish power enough, and besides at the very time it is needed perhaps the wind does not blow. But if it could be constantly employed compressing air and storing power which would be always ready, the combination would supply a great want and meet a ready sale. A. This could easily be done.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. E. K.—It is not genuine amber (succinite).—E. A. H.—No. 16 is orthoclase (rose) containing muscovite. No. 6 is quartz, orthoclase and hornblende. No. 19 is limestone (somewhat resembling the Solenhofen variety), with small seams of malachite and ferric oxide. No. 8 is shell limestone. Nos. 9, 13, 3 and 14 are also limestones. No. 1 is quartz, limestone, hornblende. No. 17 is chlorite. No. 119 is chalcopyrite with seams of lime carbonate. No. 15 is quartzite. No. 5 is similar to No. 6. No. 12 is fine ferruginous quartz conglomerate. No. 7 is orthoclase with a little hornblende. No. 11 is a dolerite with chrysolite—olivine. Unnumbered specimen—hornblende. No. 194 will be reported subsequently.—E. W. H.—Glass colored by ferrous oxide.—D. C. L.—It contains slate, calcite, galena, iron, and a little copper pyrites.—E. O. H.—Fragment of quartz with a little jasper.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Welding of a Box and Axle. By H. D. M.
Crank Motion. By E. H.
The Celestial Machine. By G. V.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Many of our correspondents make inquiries which cannot properly be answered in these columns. Such inquiries, if signed by initials only, are liable to be cast into the waste basket.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 16, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adding machine, Borland & Hoffmann	205,993
Adding stick, R. F. Roche	206,136
Arithmetical block, H. H. Hill	205,960
Armpit shield, W. E. Beames (r)	8,331
Axle box, vehicle, H. L. Isham	206,114
Bag holder, S. Robbins	206,137
Bale band tightener, J. R. Blossom	206,076
Bit clamp, A. H. Crockford	206,006
Blower, fan, I. M. Phelps	206,129
Boat detaching apparatus, B. A. Fiske	206,100
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Boiler, steam, P. F. Semonin	205,979
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Boot and shoe heels, making, G. Creter	205,948
Boots and shoes, lasting tool for, F. P. Hinds	206,019
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Box trimming machine, J. Bozorth	205,994
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Brake, car, A. B. Allen	205,987
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Washing machine, pounder, P. Hauersperger	205,959
Water meter, rotary, N. B. Acheson	206,065
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TRADE MARKS.

Bitters, T. Mesplie	560
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Cigars, Sanchez & Haya	6,379
Cigars, H. Stahlschmidt	6,380
Cigars, cigarettes, etc., G. W. Gail & Ax	6,369
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Medicinal preparation, G. S. Weaver	6,374
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Stove polish, W. Frankfurth & Co	6,356
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Whisky, J. W. Gaff & Co	6,363
Whisky, A. Hanford & Co	6,357, 6,378
Writing fluid, Carter, Dinsmore & Co	6,355

DESIGNS.

Coffin handles, W. M. Smith	10,755
Fabrics, C. Heritage	10,754
Spoons, H. Vasseur	10,756

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Matches.—J. H. White, Huntsville, Ala.
Nail machines.—W. H. Field, Taunton, Mass.
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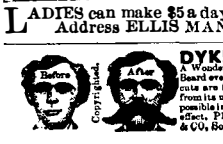

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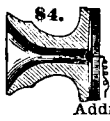

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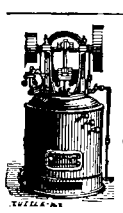

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PROPOSALS FOR IMPROVEMENTS IN MAIL-BAGS AND MAIL-BAG TAGS.

POST OFFICE DEPARTMENT,
WASHINGTON, D. C., August 15, 1878.

Proposals from patentees or their assignees, for granting the use of improvements in the construction or in the mode of opening and closing mail-bags, of any or all kinds, and in the manufacture or materials thereof, and also for the use of patented devices for tagging or labeling the same, will be received at this Department until 12 o'clock noon on the 2d day of December, 1878.

All proposals must be in accordance with the specifications and form of proposal which will be furnished on application by letter to the Second Assistant Postmaster-General.

The contracts which may be made for the use of any patents will be in conformity with such specifications and the accepted proposals.

D. M. KEY,
Postmaster-General.

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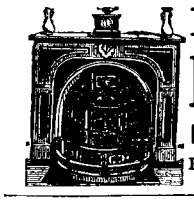

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PROPOSALS FOR MAIL-LOCKS.

POST OFFICE DEPARTMENT,
WASHINGTON, D. C., August 15, 1878.

Separate sealed proposals will be received at this Department until 12 o'clock noon on the 20th day of March, 1879, for furnishing four new and different kinds of Locks and Keys for the sole and exclusive use of the United States mails, including, besides those to be used for mail bags, such as are to be used for the street letter-boxes of the United States.

As the public exposure and searching examination necessary to intelligent bidding on any prescribed model of a lock and key would tend to impair, if not entirely destroy, the further utility of all such locks and keys for the purposes of the mails, the Postmaster-General prescribes no models or samples for bidders, but relies for a selection on the mechanical ingenuity and skill which a fair competition among inventors, hereby invited, may develop in samples submitted by them.

Specifications of requirements as to proposals, samples, kinds and quantities of locks and keys, contracts, etc., will be furnished on application by letter to the Second Assistant Postmaster-General.

No proposal will be considered which is not submitted in accordance with such specifications and forms of proposal.

The contracts which may be made are to be in conformity with the specifications and accepted proposals.

D. M. KEY,
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N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

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Lightest, strongest, and best made. Secured to the Shaft without Keys, Set Screws, Bolts or Pins; also, *Adjustable Dead Pulleys* and *Taper-Sleeve Couplings.* Send for catalogue. Address Taper-Sleeve Pulley Works, Erie, Pa.

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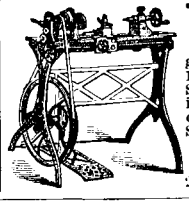

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The Rio de Janeiro GAS ILLUMINATION

By order of the Brazilian Legation at Washington the undersigned makes public that the imperial government calls for proposals for the gas illumination of Rio de Janeiro, the present contract expiring in March next. The proposals, addressed to the Envoy Extraordinary and Minister Plenipotentiary of Brazil, must be sent until three o'clock in the afternoon of the first day of December next to the Brazilian Consulate General, 42 Broadway, New York, where copies of the general conditions and specifications referred to in the fourth clause can be obtained, as well as any information in relation to this matter.

NEW YORK, Sept. 9, 1878.
SALVADOR DE MENDONCA,
Brazilian Consul General.

MINISTRY OF AGRICULTURE, COMMERCE AND PUBLIC WORKS — DIRECTORY OF PUBLIC WORKS.

By order of His Excellency the Minister of this department it is advertised that this Directory receives proposals for the service of the illumination by gas of the capital of the Empire, in the terms and conditions below specified:

First—The proposrls will be presented in a closed letter, until three o'clock in the afternoon of the 1st day of December of the present year, in this city, in the Directory of Public Works of the Ministry of Agriculture, and in London, Paris, and Washington, at the respective Brazilian legations.

Second—The proposers must present, outside of the envelopes that shall contain the proposals, documents that will testify their fitness for the service that they propose to contract.

Third—No one can concur without having previously deposited in the National Treasury, in the delegacy of the same Treasury in London, or in either one of the legations above indicated, a caution, in money or bonds of the public debt of the Empire, $50,000, or a corresponding amount in foreign money (£5,000, 125,000 francs, or $25,000 in gold).

Fourth—The object of the concurrence will be only he price of furnishing a cubic meter of gas, and the term of the privilege, that in no case can exceed 33 years. All the other clauses of this contract, excepting whatever may be transitory, will be, without any discrepancy or modification, those proposed by the government in the general specifications and conditions, which will be distributed separately in the Directory of the Public Works and the above mentioned legations.

Fifth—All the proposals will be opened in this city, in the public session of the Directory of Public Works, on the 2d day of January, 1879; and the government will declare on them within 15 days of that date.

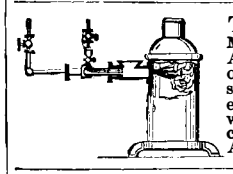
Sixth—When the choice of the proposal is made the contract will be considered concluded; being necessary for the preferred proposer to sign only the mentioned general conditions, which will be entered in a competent book of the Department of Agriculture. For greater facility, each proposer who resides out of Rio de Janeiro must constitute in this city and with a due antecedence somebody with a power of attorney to sign the general conditions in case the preference falls on him.

Seventh—The proposer who, after having received communication of the acceptance of his proposal, refuses to sign the referred conditions, will forfeit the caution in the benefit of the National Treasury.

Eighth—The government reserves the right to annul the competition within the period fixed by clause 5, to decide upon the proposals that were presented.

DIRECTORY OF PUBLIC WORKS, Rio de Janeiro, July 22, 1878.

M. BUARQUE DE MACEDO,
Chief of the Directory.



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formed the FAMOUS COMBINATION of New York and Boston capitalists in February, 1875, on UNION PACIFIC STOCK, and how this combination forced the stock from 37 up to 82¾ before the end of November, same year, are matters of well known history. The various members, each one,

MADE HIS FORTUNE

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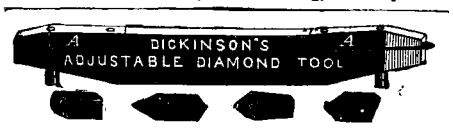

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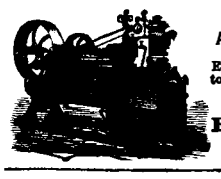

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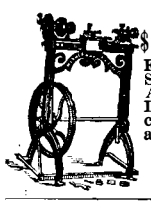

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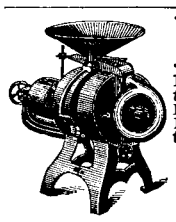

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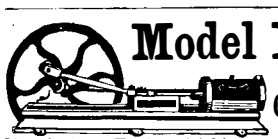

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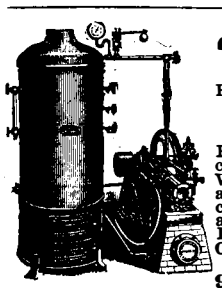

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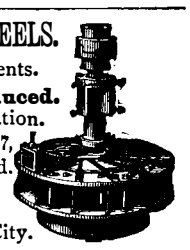

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